July

BROADCAST WRNY STATION

25 Cents

Science and Invention

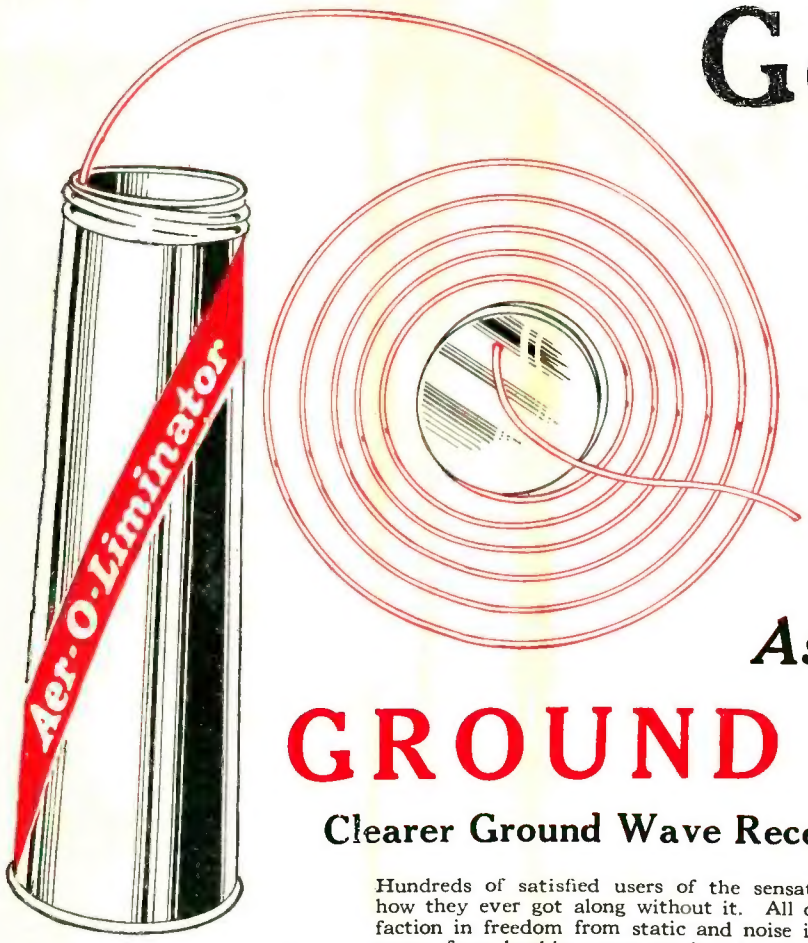
SEE PAGE 206

EXPERIMENTER PUBLISHING COMPANY, 230 FIFTH AVENUE, NEW YORK

Get Winter Reception *in* Summer *with* *Astounding Successful*

GROUND ANTENNA

Clearer Ground Wave Reception Allows Greater Distance



Hundreds of satisfied users of the sensational Ground Antenna—Aer-O-Liminator—are wondering how they ever got along without it. All over the country radio owners are finding marvelous satisfaction in freedom from static and noise interference. This revolutionary improvement of reception comes from hooking your receiver to Ground Wave Reception. Radio engineers tell you that the broadcast wave through the ground is in most cases almost static-free, and with rare exception carries no noise interference.

Read Proof!

"I have tested and thoroughly approve the Aer-O-Liminator. I find it increases selectivity and volume without distortion, practically eliminates static, gives good, clear tones, both on local and distant stations.

I would recommend the use of Aer-O-Liminator to every radio owner to get the best reception from his set."

JOHN E. CHRISTENSEN
(Radio Engineer.)

• • • •

"There's no such thing as static trouble since I got my Aer-O-Liminator. I get stations I never got before—so loud and clear I would almost swear they were in the next room."

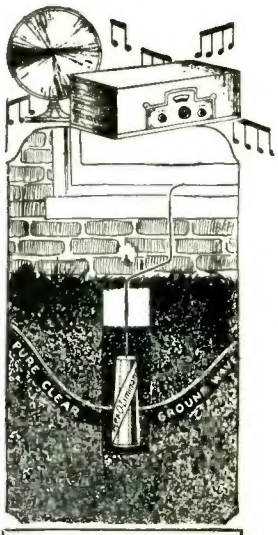
R. CURTIS,
Illinois.

Natural Tone—Better Selectivity

The rapidly increasing army of Aer-O-Liminator owners also enjoy and appreciate the natural human tone and clarity of this Ground Wave Reception. If you haven't tried it you can't imagine the difference!

Another advantage users have found with Aer-O-Liminator is the surprising DX they get. Distant stations formerly drowned out by static or noise interference of air waves now come in clear as a bell. Selectivity is improved because, with pure, clear Ground Wave Reception, you can pick up and log signals that before were lost in the jumble of shrieks and howls so common in DX reception through air waves.

You shouldn't deprive yourself of the new thrill of pure, clear ground wave reception a day longer than necessary. We let you prove it for yourself.



EASY TO INSTALL
Just dig a small hole about 6 inches in diameter and drop Aer-O-Liminator into it.

FREE TRIAL

Make This Thrilling Test At Our Risk!

Install an Aer-O-Liminator (Ground Antenna). Leave your old overhead aerial up. Try out on a night when static is bad. If you do not get a wonderful improvement in freedom from static, greater selectivity and clear, sweet tone without interfering noises, if you can't get good receptions on stations that are drowned out by static on your roof aerial, you need not pay us a red cent for this test! Send coupon at once for scientific explanation of Aer-O-Liminator (Ground Antenna), proof of performance, and our conclusive iron-bound guarantee and remarkable Free Trial Offer—Mail Coupon TODAY!

Aer-O-Liminator (Ground Antenna)

Passed by the National Board of Fire Underwriters. Meets requirements of the National Electrical Code.

Endorsed by Foremost Engineers and Dealers.

CURTAN MFG. COMPANY

Dept. 863-K.A. 154 East Erie St. Chicago, Ill.

Rush This Important Coupon

CURTAN MFG. COMPANY,
154 E. Erie St., Dept. 863-K.A., Chicago, Ill.

Please send me at once complete description of Aer-O-Liminator, with details of guarantee, Scientific Proof, and Free Trial Offer.

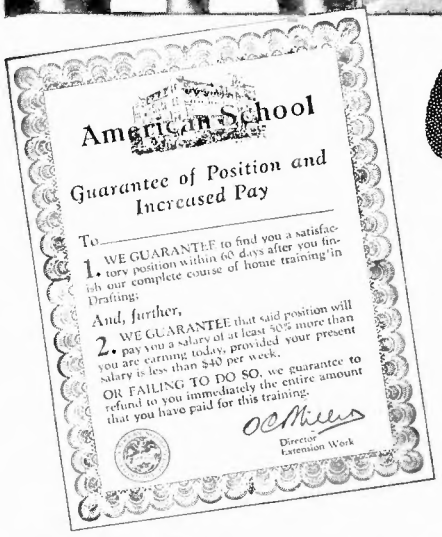
Name.....

Address.....

City.....

State.....

Training
PREPARING you to fill a fine Drafting job at a substantial raise in pay . . .
Employment
FINDING you the better-paid position and PLACING you in it, or money refunded . . . .


American School
Guarantee of Position and Increased Pay
To
1. WE GUARANTEE to find you a satisfactory position within 60 days after you finish our complete course of home training in Drafting.
And, further,
2. WE GUARANTEE that said position will pay you a salary of at least 50% more than you are earning today, provided your present salary is less than $40 per week.
OR FAILING TO DO SO, we guarantee to refund to you immediately the entire amount that you have paid for this training.
O. C. Miller
Director Extension Work

Come into Drafting!

Men who can read blue-prints and draw plans are "sitting pretty" these days. No wonder, when you consider that every machine, every building, all industrial activities *start* on the Drafting table! Intensive production, record-breaking construction operations, have created a great demand for expert Draftsmen capable of designing and calculating original plans.

$50 to $125 a week paid to Expert Draftsmen

Get this point—that Drafting isn't just *one* line of work—it reaches out into the Electrical, Manufacturing, Building Construction, Automotive and Structural industries. That is why you'll find well-paid Drafting positions advertised in all industrial centers of the U. S. 70,000 vacancies reported in the past 12 months. And that is why I advise men to go into Drafting, particularly if handicapped by lack of high-school or college education. Today you are in competition with high-school and college graduates for the better-paid jobs. You must have *specialized training* to win.

The Entering Wedge to Success in all Building and Manufacturing Lines

I recommend Drafting, too, because it can be QUICKLY learned at home, in spare time—without quitting your job, without losing a day's time or a dollar in pay. Because you're sure there will be a good position waiting when you are ready for it. And because the work is so fascinating and offers better-than-ordinary chances for advancement. For the Draftsman is in close contact with important work and BIG MEN, and he is right in line for promotion to Superintendent and other executive positions.

A Drafting Job GUARANTEED

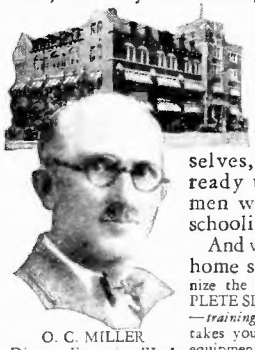
paying 50% more than you earn today —or not a penny of cost!

Now, at a cost you can afford, on terms of only $6 per month, you can actually BUY a fine Drafting position and a substantial increase in pay. A million-dollar institution guarantees both—the training, then the employment. *Under money-back penalty.*

This agreement brings you your SECOND CHANCE. To repair a neglected education, to specialize, to change to a line where you can get ahead more rapidly. Read it, and investigate it!

The American School

Chartered 30 years as an EDUCATIONAL institution and like the best resident schools and colleges, conducted NOT FOR PROFIT. We offer complete, thorough up-to-date instruction, built by 200 leading Educators, Engineers and Executives. A unique instruction, built to meet the specifications of well-paid jobs as laid down by employers themselves, yet simplified for ready understanding by men with only common schooling.



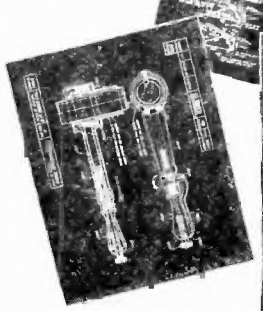
O. C. MILLER
Director Extension Work

And we are the first in the home study field to recognize the need of giving a COMPLETE SERVICE to ambitious men —*training, plus employment.* Which takes you as you are, supplies the equipment you lack, and lands you in the better job you seek. Without risk to you!

3 Drafting Lessons *Actually* FREE!

to prove you can learn at home, in your spare time!

You will never have a more serious personal problem than deciding your future life-work—so we merely urge you to LOOK INTO Drafting. See how you like it, see if you learn as readily as most men do, get the facts about the opportunities, the salaries paid, the jobs open, the chances for promotion. This is why, on receipt of your name, we will send you *the first three lessons of our Drafting course* without cost or obligation.



O. C. MILLER, Director Extension Work,
THE AMERICAN SCHOOL,
Dept. DB-294 Drexel Ave. & 58th St.,
Chicago, Illinois

Please send without cost or obligation:

1. Three Drafting Lessons.
2. Facts about the opportunities in Drafting.
3. Your Guarantee to train and place me under money-back penalty.

Name_____

Address_____

Age_____ Occupation_____

The American School

Dept. DB-294 Drexel Ave & 58th St. ,Chicago, Ill.

Vol. XVI
Whole No.
183

Science and Invention

Formerly ELECTRICAL EXPERIMENTER
COMBINED WITH "THE EXPERIMENTER"

EDITORIAL, ADVERTISING AND GENERAL OFFICES:
230 Fifth Avenue, New York City

Published by Experimenter Publishing Company, Inc. (H. Gernsback, Pres.; S. Gernsback, Vice-Pres. and Treas.; C. E. Rosenfelt, Sec'y.

Publishers of SCIENCE AND INVENTION, RADIO NEWS, RADIO LISTENERS' GUIDE, AMAZING STORIES and FRENCH HUMOR

JULY
1928
No. 3

Editorial Staff

HUGO GERNSBACK, *Editor-in-Chief.*
H. WINFIELD SECOR, *Managing Editor.*
T. O'CONOR SLOANE, PH. D., *Associate Editor*
JOSEPH H. KRAUS, *Field Editor.*
PAUL WELKER, *Radio Editor.*
S. GERNSBACK *Wrinkles Editor.*
W. J. ROMAINE, *Art Director.*

Contributing Editors

Astronomy—
Dr. Donald H. Menzel, Ph.D., Lick Observatory; W. J. Luyten, of the Harvard College Observatory.
Entomology and Allied Subjects—
Dr. Ernest Bade, Ph.D.
Physics—
Dr. Harold F. Richards, Ph.D., Ernest K. Chapin, M.A., Dr. Donald H. Menzel, Ph.D.
Chemistry—
Raymond B. Wailes, Dr. Ernest Bade, Ph.D.
Automotive Subjects— George A. Luers
Radio— A. P. Peck, Herbert Hayden.
Magic and Psychic Phenomena—
Joseph Dunninger, Joseph F. Rinn, Edward Merlin.
Foreign Correspondents—
Dr. Alfred Gradenwitz, Germany; Dr. H. Becher, Germany; C. A. Oldroyd, England; S. Leonard Bastin, England; Count A. N. Mirzaoff, France; Hubert Slouka, Czecho-Slovakia; P. C. van Petegem, Holland; Richard Neumann, Austria.

IN AUGUST ISSUE

Animal Superstitions

Mr. Raymond L. Ditmars, curator of mammals and reptiles, New York Zoological Park, will explode many false theories concerning animals.

Home-made Summer Amusements

Constructional details describing how to build simple amusements for the small pond and lake shores, the cost and labor required being very slight.

Why Is a Skyscraper?

Skyscrapers are common enough to thousands of people; but the mystery of how they are constructed and why they are desirable, forms an unusually interesting story.

Atlantis! Land of Mystery—

History and science seem to agree that a lost continent known as "Atlantis" once existed, forming a land bridge between the Americas and Europe. Don't miss this enthralling article.

CONTENTS OF THIS NUMBER

GENERAL SCIENCE

Editorial 199
By Hugo Gernsback
Our Spiritualistic Investigations 200
By Joseph H. Kraus
It's All Bunk 204
By Sam Brown
Deep-Sea Motion Picture Camera 206
By H. Winfield Secor
Movies Via Telephone Wire 207
Phoney Inventions—New Prize Contest 208
By Hugo Gernsback
Scientific Progress—Popularly Illustrated 210
The Strangest of All Laws 212
By Uthai Vincent Wilcox
Synthetic Diamonds Now Possible 214
By Lucien Fournier
The Month's Scientific News Illustrated 216
By George Wall
Super-Power Cathode Ray Tube 217
A Folding Speed Boat 217
Science Calms Ocean Waves 218
Recording Your Own Pulse 221
By Dr. A. Gradenwitz
Automatic Movie Film Developer 222
Magic—A Monthly Feature 223
By Dunninger
The Metal Emperor—Tenth Installment 224
By A. Merritt
Distorted Perspectives 228
Can You Answer These Scientific Questions? 230
A Huge European Train Ferry 230
Model Department—Monthly Cup Award 231
Wood Turning—First of a Series 232
By H. L. Weatherby
Readers Forum 241
Scientific Humor 248
Latest Patents 249
The Oracle 250
Patent Advice 266

CHEMISTRY

Experimental Chemistry and Electrics 234
Edited By T. O'Conor Sloane, Ph.D.
Home-made Fireworks 235
By Dr. Edna R. Hamburger
Some Chemical Experiments With Light 236
By Raymond B. Wailes

RADIO

Radio Story of the "Bremen" 242
Fireboats Directed by Radio 243
A New Electric Set 244
Secret Radio Telephony 245
New Radio Devices 246
Radio Oracle 247

SCIENTIFIC FICTION

The Metal Emperor 224
By A. Merritt

AUTOMOTIVE

Battery Filler 220
Motor Hints 226
Conducted By George A. Luers
Auto Theft Prevention 227

HOW-TO-MAKE-IT

Wood Turning—First of a Series 232
By H. L. Weatherby
Home-made Electric Furnaces 234
By Robert L. Lewis
Home-made Fireworks 235
By Dr. Edna R. Hamburger
Camera-less Photography 237
By C. A. Oldroyd
Constructor Department 238
How-To-Make-It Department 239
Wrinkles, Recipes and Formulas 240
Edited By S. Gernsback

HOW TO SUBSCRIBE FOR "SCIENCE AND INVENTION." Send your name, address and remittance to Experimenter Publishing Co., 230 Fifth Ave., New York City. Checks and money orders should be made payable to Experimenter Publishing Co., Inc. Mention magazine desired, inasmuch as we also publish RADIO NEWS, AMAZING STORIES, RADIO LISTENERS' GUIDE, and FRENCH HUMOR, a weekly. Subscriptions may be made in combination with the other publications just mentioned at special reduced club rates. Send postal for club rate card. Subscriptions start with the current issue unless otherwise ordered. ON EXPIRATION of your subscription we enclose a renewal blank in our last number to you, and notify you by mail. Then, unless we receive your order and remittance of a renewal, delivery of the magazine is stopped.

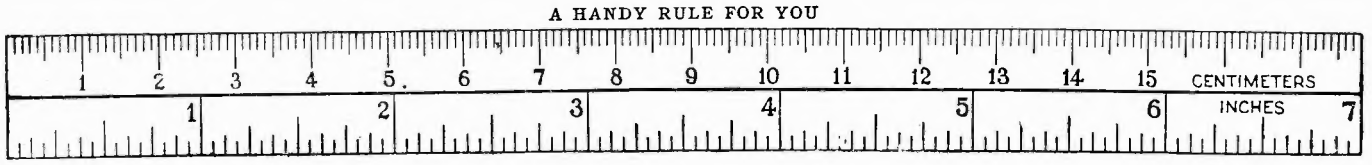
SCIENCE AND INVENTION is published on the 10th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries, $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25c each. All communications and contributions to this journal should be addressed to Editor., SCIENCE AND INVENTION, 230 Fifth Ave., New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. SCIENCE AND INVENTION Monthly. Entered as second-class matter May 10, 1924, at the Post Office at New York, N. Y., under the act of March 3, 1879. Additional entry at Dunellen, N. J. and San Francisco, Calif. Title Registered at the Patent Office. Copyright, 1928, by E. P. Co., Inc., New York. The Contents of this Magazine are copyrighted and must not be reproduced without giving full credit to the publication. SCIENCE AND INVENTION is for sale at all newsstands in the United States and Canada. European Agents, S. J. Wise Et Cie, 40, Place Verte, Antwerp, Belgium.

ADVERTISING DEPARTMENT

New York Office:
Rhodes & Leisenring,
624 Graybar Building

Chicago Office:
Rhodes & Leisenring,
307 North Michigan Avenue

A HANDY RULE FOR YOU



Dr. T. O'Conor Sloane will teach you CHEMISTRY Right in your own Home

Good Chemists Command High Salaries

T. O'CONOR SLOANE
A.B., A.M., LL.D., Ph.D.

Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry in the classroom, but he was for many years engaged in commercial chemical work.

Industrial firms of all kinds pay tempting salaries to get the right men. Salaries of $10,000 to $12,000 a year are not unusual for chemists of exceptional abilities. Chemistry offers those who are ambitious and willing to apply themselves conscientiously the greatest opportunities of any vocation. Why be satisfied with small pay and hard, thankless work—learn the profession of Chemistry and your salary will depend only upon your own efforts and your own abilities.

The work of the chemist is extremely interesting. If you are fond of experimenting, if you like exciting and fascinating work, take up Chemistry. To the man who is dissatisfied with his present job, to the young man just deciding on his life work, Chemistry holds alluring charms and countless opportunities. If you want to earn more money, the way is open through our course in Chemistry.

NOW IS THE TIME TO STUDY CHEMISTRY

Never before has the world seen such splendid opportunities for chemists as exist today. The war has awakened the United States to the need of trained chemists and chemical engineers. Everywhere the demand has sprung up. In factories, mills, laboratories, electrical shops, industrial plants of all kinds, chemistry plays a vital part in the continuation and expansion of the business. In every branch of human endeavor the need for chemists has arisen. No profession offers such alluring opportunities, and the next ten years are going to show the greatest development in this science that this country has ever seen. Those who have the foresight and ambition to learn chemistry now will have the added advantages and greater opportunities afforded while the chemical field is growing and expanding.

What Well-Known Authorities Say About Our Course

From Hudson Maxim:
"Dr. Sloane has done a much-needed work in a much better way than anything of the kind has, heretofore, been done.
"Dr. Sloane has a remarkable faculty of presenting Science for self-instruction of the student in such a clear and understandable way as to be most readily grasped and assimilated.
"I, therefore, unreservedly recommend and place my highest indorsement on his work."

From Dr. W. W. de Kerlor:
"I can not recommend your course too highly and I congratulate both you and Dr. Sloane on same."

From John A. Tennant:
"This is something which has long been needed. Your long experience in the teaching of chemistry . . . assurance that the course will be practical as well as plain to the untrained students."

What the Students Say:

"Your course has been worth $50,000 to my concern."
"This is just like reading some fascinating fiction story."
"I have just been made Assistant Chemist of my concern."
"Your course is just what a person wants to start in the wonderful science of Chemistry."
"I find that your course is very intesting. I wait patiently for the next lesson."
"I find the study of chemistry more and more interesting at every lesson and you may be sure that I am getting into studying habit even more than I ever did even in my school days."
"I like the lessons so much that I honestly would not sell them for many times their price."
"I am taking this opportunity to express my satisfaction with your chemical lessons."
"I now have a fine position as chemist at the Du Pont Dye Works. It was thru your course alone that I have been so successful."
"I have written to different people about your course and they speak very highly of same."
"If I don't learn it isn't your fault for I find that your lessons contain a whole lot."

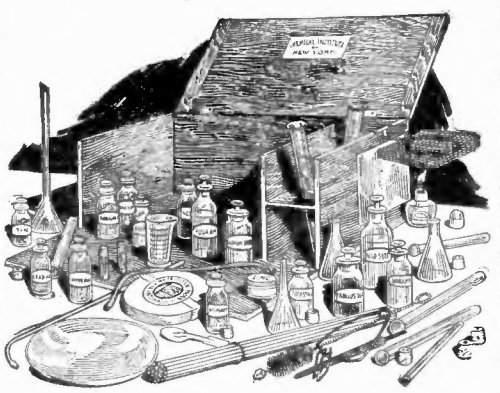
(Names and addresses on request.)

You Can Learn At Home

Ability to Understand Plain English the Only Requirement

Dr. Sloane will teach you Chemistry in a practical and intensely interesting way. Our home study course written by Dr. Sloane himself is practical, logical and remarkably simple. It is illustrated by so many experiments that are performed right from the start that anyone, no matter how little education he may have, can thoroughly understand every lesson. Dr. Sloane teaches you in your own home with the same individual and painstaking care with which he has already taught thousands in the classroom. He will, in addition, give you any individual help you may need in your studies. This personal training will be of inestimable value to you in your future career.

Experimental Equipment Given to Every Student



We give to every student, without additional charge, this chemical equipment, including fifty pieces of laboratory apparatus and supplies and thirty-nine different chemicals and reagents. The fitted heavy wooden box serves not only as a case for the outfit but also as a laboratory accessory for performing countless experiments. Full particulars about this special feature of our course are contained in our free book "Opportunities for Chemists."

DIPLOMA AWARDED TO EACH GRADUATE

Upon graduation each student is awarded our Diploma in Chemistry, certifying that he has successfully completed his studies. Your name on this certificate will be a source of pride to you all your life, as well as an aid to obtaining a position in Chemistry.

Easy Monthly Payments

You do not have to have even the small price of the course to start. You can pay for it in small monthly amounts or earn it as many others are doing. The cost is very low, and includes even the Chemistry outfit—there are no extras to buy with our course. Write us and let us explain how you can qualify for a trained technical position without even giving up your present employment.

MAIL THE COUPON FOR FREE BOOK

Your name and address on the coupon will bring you by return mail our interesting free book, "Opportunites for Chemists" and full particulars about the course and what it will do for you. You owe it to yourself to get this book. Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail to us. But whatever you do, act today.

CHEMICAL INSTITUTE OF NEW YORK
Home Extension Division 7
16-18-S-East 30th St.,
New York, N. Y.

Please send me at once, without any obligation on my part, your free book, "Opportunities for Chemists," and full particulars about the Experimental Equipment given to every student. Also please tell me about your plan of payment.

NAME.....

ADDRESS.....

CITY.....STATE.....

S & I-7-28

Don't Wait--Mail the Coupon NOW!

CHEMICAL INSTITUTE of NEW YORK, Inc.
16-18-S-EAST 30TH STREET Home Extension Division 7 NEW YORK, N. Y.

INDEX TO ADVERTISERS

PAGE

A

American Chime Clock Co. 282
American Detective System 270
American School 282
American School, The 193
American School of Aviation 279
American School of Photography 272
American Telephone & Telegraph Co. 257
Andrews, Frank 256
Anita Company 271
Apparatus Engineering Co. 279
Audel & Co., Theo Inside Back Cover
Automatic Rubber Co. 254
Aviation Institute of U. S. A. 265

B

Bliss Electrical School 278
Boeing, M. L. 285
Breakers, The 275
Buescher Band Inst. Co. 273
Bureau of Inventive Science 268
Burke & Bros. 278

C

California Laboratories 272
Chemical Institute of N. Y., Inc. 195
Coleman, Watson E. 266
Conn, Ltd., C. G. 282
Consrad Co., Inc. 252-258-270-278-280
Coyne Electrical School 197
Cox, S. J. 254
Curtan Mfg. Co. Inside Front Cover

D

Detroit School of Lettering 268
Douglas, Lyle 270
Dryer, Prof. J. A. 279

E

Electrical Service Bureau, The 265
Elfco, F. A. 261
Elto Outboard Motor Co. 265
Eston Mfg. Co. 279
Evans & Co., Victor J. 269

F

Fawcett Publications, Inc. 251
Fisher Mfg. Co., Adam 266
Flash Sales Corp., The 280
Franklin Institute 257-268
Franklin Publishing Co. 263-271

G

Gilson Slide Rule Co. 275
Givens, E. S. 271
Gordon Mfg. Co. 271

H

Haywood Tire Equipment Co. 273
High School Home Study Bureau 278
Hobart Bros. Co. 261-273
Hoenack, Paul 268

I

Ideal Aeroplane & Supply Co. 279
International Correspondence Schools 254-259-274-280

J

Jenkins Corp. 257-273-285

K

Kelsey Co., The 270
Kitchin, Edgar M. 266

L

Lacey & Lacey 268
Lancaster & Allwine 268
Landon School, The 263
LaSalle Extension University 272
Lederer School of Drawing 281
Leonard, A. O. 263
Le Page's Glue 280
Liederman, Earle E. 275
Lydon Mfg. Co. 277

Mc

McCathran, Irving L. 268
McGraw-Hill Book Co., Inc. 255

M

Madison Shirt Manufacturers 274
Mann & Benton 273
Mead Cycle Co. 274
Mega-Ear-Phone, The 277
Metal Cast Products Co. 282
Miller, Monroe E. 266
Miniature Ship Models, Inc. 256
Motion Picture Publications, Inc. 198
Movie Operators School 278
Munn & Company 268

N

National Electrical School 256
National Radio Institute 273
New Method Mfg. Co. 277
New Way Spray Gun Co. 285
New York Electrical School, The 271
New York Institute of Photography 261
North American Finance & Development Corp. 268
Norton Institute 256

O

O'Brien, Clarence A. 267

P

Parks Woodworking Machine Co., The 260
Pelman Institute of America, The Back Cover
Perfect Penmanship Institute 280
Petroleum Engineering University 268
Plymouth Rock Squab Co. 282
Pohl Bros. 277
Polachek, Z. H. 268
Polk & Co., R. L. 281
Popular Book Corp. 288
Press Guild, Inc. 262
Publishers Classified Service 283

R

Radio Association of America 285
Radio Institute of America 263
Radio Specialty Co. 261
Randolph & Co. 266
Ross-Gould Co. 263

S

Seaside Hotel, The 263
Sinclair, Mr. 279
South American Service Bureau 273
South Bend Lathe Works 265
Standard Business Training Institute 275
Strongfort Institute 281
Studebaker Corp. of America, The 253

T

Tamblyn, F. W. 257
Tarbell System, Inc. 271
Townsend Labs. 281
Treasure Sales Co. 268
Tri-State College 272
Trilety, M. 265-275

U

U. S. Volunteer Air Service 260
Underground Aerial Systems 259
Universal Plumbing School 270
University of App. Science 277

V

Van Deventer, H. R. 266

W

Wineholt Co. 275
Wollensak Optical Co. 277

Now! in limp, suede leather binding

S. Gernsback's Radio Encyclopedia

THE most valuable of Radio Books—S. Gernsback's Encyclopedia—*now the most beautiful.* This foremost Radio Encyclopedia is now offered in this luxurious new binding to meet the demand for a more handsomely bound volume. The limp suede leather edition sells for $5.00. The Keratol-leather stiff binding still can be had for $2.00.

Remember—this is an encyclopedia—not a dictionary! It took over two years of intensive labor to compile it. It is the first Radio Encyclopedia ever published.

S. Gernsback's Radio Encyclopedia contains the meaning of every word and phrase used in the entire Radio Art. Every circuit, part and apparatus is thoroughly explained. A complete cross index is just one of the many features of this remarkable book.

There are 1,930 definitions—549 diagrams, photographs and drawings—all simple and easily understood. The book is nearly 1 inch thick and measures 9x11 inches.

S. GERNSBACK, 230 FIFTH AVENUE, NEW YORK CITY

S. GERNSBACK
230 Fifth Ave., New York City
Kindly send me one copy of the Radio Encyclopedia. I will pay postman.
☐ Limp suede leather binding $5.00 plus postage.
☐ Keratol-leather binding $2.00 plus postage.
(check which binding you want)
Name.....
Address.....
Town.....
State.....

SEND NO MONEY

Simply pay the postman on delivery.

Over 25,000 copies in the stiff binding already sold.

Say-Fellows!

H. C. LEWIS, Pres.

This message comes from me to you fellows who are making less than $75.00 a week. To the fellow who is right now thinking about what his future will be 5, 10, or 20 years from now... I'm talking to the fellow who is thinking in terms of $60, $75 or $100 a week... If you want a future, a salary that will make it possible for you to get the good things in life for yourself, your family or the family you will someday have, then you can't afford to fail to read every word of this page.

What I Say I'll Do for YOU—I've Done for Thousands of Others!

I don't ask you to take my word for it, but I do ask you to make me prove it. A copy of my big Free book will be sent you if you fill out the coupon on the bottom of this message. This book will give you a word and picture story of how I have taken thousands of fellows, (not one bit smarter than you) and after a few weeks of the most interesting training put them into a trade where they made salaries of $60, $75, $100 and more a week. In many cases these fellows made three and four times as much after my training as they ever thought of making before.

Electricity Offers You a World of Opportunities

As a trained Expert Electrician a world of opportunities is opened to you, even though you may be doing something right now a thousand miles away from this subject. To the fellow doing farm work, factory work, laborer, clerk, mailmen, chauffeurs, etc., electricity offers opportunities to become salesmen, executives, power house operators, superintendents in power plants, armature winders, contractors, radio experts, and dozens of other things. The world of electricity is just opening. What has been done is nothing to what will be done in the years to come. To enter this field today means you are getting in on the ground floor.

I Train You Thoroughly as You Should be Trained

I don't train you by correspondence but on actual live electrical machinery. Here in my great shops you are trained as you never dreamed you could be trained. You are trained from A to Z. You start in on the most simple door bells, buzzers, etc., and gradually advance through the different departments to house wiring, contracting, armature work, D C and A C motors, generators, dynamos, switchboards, etc. Auto ignition, starting and lighting, building batteries, etc. And I give you this training in 12 weeks because I have eliminated all unnecessary useless theory and give you the actual training and experience you get in the field.

Earn While You Learn

I run an employment department to assist my students to get work if they need it to help pay their expenses while attending school, **then** after graduation I give them real employment service not only on graduation but any time during their life.

I am Making a Very Unusual Offer NOW!

We are now in our big new fireproof building lighted on all four sides by natural daylight. As a special inducement at this time I'm making a special low price offer and in addition I'm including my Radio Electrical course and my Auto, Truck and Tractor Electrical course and besides **I'm paying railroad fare to Chicago to all who enroll now.** Even though you are unable to come to school right now I will show you how you can still get this offer that's in effect now and come to school later.

My Big Free Book Tells You the Whole Story

This big book containing over 150 actual reproductions of photographs tells you everything and shows how thousands of others have lifted themselves out of a small, man killing job to a big pay man. It cost me a dollar to print but a copy is waiting for you FREE if you fill out and mail the coupon.

COYNE ELECTRICAL SCHOOL

H. C. Lewis, Pres. *Dept. B-883* *Founded 1899*

500 South Paulina St. **Chicago, Ill.**

Coyne Electrical School, *H. C. Lewis, Pres.*
Dept. B-883 500 So. Paulina St., Chicago, Ill.

Dear Mr. Lewis: Without obligation send me your big free catalog and all details of Free Employment Service, Radio and Automotive Courses and how I can "earn while learning." Also tell me about your offer of railroad fare to Chicago.

Name .....

Address .....

City ..... *State* .....

Special
One Dollar Offer

Subjects:

Mary Astor
Clara Bow
James Hall
Jack Holt
Fred Thomson
Sally O'Neil
Ruth Taylor
Ralph Forbes
Olive Borden
John Gilbert
Dolores Costello
Marcelline Day
Renée Adorée
Eleanor Boardman
Charles Farrell
Tom Mix
Rudolph Valentino
Janet Gaynor
Joan Crawford
June Collyer
Vilma Banky
Ramon Novarro
Rod LaRocque
Lloyd Hughes

You can have this wonderful set of pictures of your favorites if you act promptly. For a limited time we offer you this fine set of 24 new gravure pictures, size 5½ by 8 inches, with the next four issues of MOTION PICTURE MAGAZINE, for One Dollar. That's a bargain! The pictures are just the thing for your den or your collection. Suitable for framing, too. Just pin a dollar bill to the coupon and mail to-day. Subscribe for your friends and we will send them each a set of pictures. Do it now!

Canada, twenty-five cents extra—Foreign, fifty cents extra.

7 S. I.

MOTION PICTURE PUBLICATIONS, INC., **Offer No. 3**
Paramount Bldg., New York.

For the enclosed $1.00 please send me the set of twenty-four new pictures of motion picture stars and the next four issues of MOTION PICTURE MAGAZINE.

Name.....

Address.....

.....

Start with.....issue.

Volume XVI
Whole No. 183

Science and Invention

July, 1928
No. 3

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, PH.D., *Associate Editor*
Editorial and General Offices - - - - - - - - 230 Fifth Avenue, New York

"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - - - - - - - - - - *HUXLEY*

SPIRITUALISTIC PHENOMENA

By HUGO GERNSBACK

THERE is hardly a subject which has baffled and irritated scientific investigation as much as spiritualism during the past decade. There is nothing quite so unsatisfactory and that lends itself to a scientific study with as little success, as spiritualism. The vagaries of the human mind, and personal belief and disbeliefs that enter into the subject make for a tremendous handicap, and after everything has been said and done, no satisfactory result has been achieved or probably will be achieved for ages to come.

The underlying reasons for this, to the scientific mind are rather simple. It is impossible, at all times, to get a spiritualistic medium to perform under strictly scientific conditons. Almost all of them insist upon religious and churchlike settings.

Practically always the room where the séance is held must be in total darkness, while the observers are asked to hold hands; not to cross their legs and other equally childish nonsense. So far, it has been impossible to get a medium to perform in daylight, or in a reasonably subdued light. It is true, that some of the mediums perform in a very dim light, but this condition is most unsatisfactory; the room might just as well be in total darkness, because at no time is there sufficient illumination to really make a careful investigation of what takes place. Very few mediums, if any, ever will consent to perform in the laboratory, properly equipped with scientific apparatus, under conditions that make it possible to conduct a real scientific investigation. Practically all mediums insist upon having with them their managers or their "interpreters"; and under such conditions, almost anything is possible.

The favorite tactics of most mediums is to *wear out* the investigators by long waits, and it sometimes takes hours to produce any phenomena at all. Under such conditions, the investigators are wearied, and their senses have been dulled to such an extent, that frequently the medium is enabled to produce "phenomena," which he or she would find impossible to accomplish in relatively good light. There is no arguing with the medium to perform in daylight, because you will be told that the spiritual influences that come from beyond the grave insist upon darkness! What can the scientific investigator do against such palpable nonsense?

It would seem to be plain logic, that every medium should be only too glad to submit to scientific laboratory tests if his phenomena were genuine; because if they were, spiritualism certainly would greatly gain and would have nothing to lose. It would then become an accepted science, like the other physical sciences, but there seems to be no immediate prospect of accomplishing anything like this, because spiritualism must have its mummery.

That some of the greatest spiritualistic mediums have been caught in actual fraud, as for instance, the famous Madame Palladino, means nothing to all the other mediums. Here the argument is, that in the first place, Palladino was not exposed; and second, if she were, there certainly are other mediums who are positively not fakers and who have not been caught in trickery.

So again, you get nowhere. On the other hand, I wish to make it plain right here, that I do not accuse the average medium of *conscious* fraud. Indeed, I believe that most of them are perfectly honest, and act in good faith. It seems to be true, however, that every sincere medium goes into a trance, which is hypnotic in its effect, and in such a trance, ALL of the faculties of the medium are raised to the *nth* degree, and he or she is enabled to do things that they could never do while in their waking moments. While in such an auto-hypnotic or self-imposed trance, which is only another form of an exalted sleep—the medium becomes an automaton; remember that a distorted but sub-conscious mind is always a most tricky thing, and almost anything can and will happen.

You may never have fallen into a spiritualistic trance, but everybody will understand that even during ordinary sleep, it is well known that we do things of which we have no consciousness. We scratch our faces; we turn and toss about; we even walk in our sleep, as somnambulists do, and perform other remarkable things of which we are totally unconscious after we awaken. Yet, we are not called fakers, but we understand that phenomena such as those which take place while we are asleep are not of a supernatural kind but are perfectly natural and are based upon good physical science. There is nothing mysterious here.

The same thing is the case when a person is hypnotized; during such a state, which is nothing but a trance, the human being can be made to perform the most incredible feats, of which practically none will be remembered after the subject has been restored to consciousness.

Of course, every medium will deny this and will insist that whatever manifestations occur, come from beyond the *border line of the spirit world*, and that during the trance, the body of the medium is possessed by the spirit or spirits of the departed. As a matter of fact, no medium could possibly work and produce any phenomena at all, if he or she did not believe implicitly in that doctrine. Without question, it is this belief, that makes them carry on their work.

If spiritualism was reduced to a natural every-day plane, where practically everybody was free to produce the same phenomena, spiritualism would lose all its fascination for a certain class of people, who ought to know better. Then spiritualism would sink to an every-day, common-place practice, and no one would pay any greater attention to it, than they do to the mysteries of a gasoline engine or the wonders of an X-ray machine, and which, by the way, are far more wonderful than any spiritualistic manifestation.

When I say that I believe that a spiritualistic medium in a trance actually does produce manifestations, I am fully aware of the import of this statement. Just because certain phenomena cannot be immediately explained, does not necessarily mean that they are *supernatural*. Even *ectoplasm* can be explained in a perfectly natural manner. Some few scientists who actually have seen the elusive ectoplasm, claim that it is nothing but a regurgitation of mucus if arising from the mouth or nose under stress of an auto-hypnotic trance; that ecotplasm can, and does, perhaps, assume the shape of a head or a human figure is not at all impossible. You can throw down a silk handkerchief a dozen times, and it will assume different shapes every time. Then under an uncertain light, you can translate the certain shapes for something else, *if only you believe sufficiently in the phenomena;* and ectoplasm certainly, if it ever has been produced, would fall into the same class.

All the other phenomena and so-called supernatural effects can be produced and explained by perfectly natural means, and we have actually done so many times. Any good magician can do much better than the best medium, and can actually produce better phenomena and more interesting ones, under far more difficult conditions than the average medium can show us.

But I am not at all hopeful that this settles the controversy one way or another. Those who believe in spiritualism, will—as usual—attack me most violently, and I will be told that I have not the slightest idea of what I am talking about. But then, I am used to this, and do not mind it any longer.

Mr. Hugo Gernsback speaks every Tuesday at 9.30 P. M. from Stations WRNY (326 meters) and 2XAL (30.91 meters) on various scientific subjects.

The first séance given by Nino at Mrs. Houdini's home. Even though Nino was securely bound, the parted curtains clearly indicate he was able to raise his hands as high as his face. Mrs. Houdini and Mr. Dunninger are holding hands across the front of the table

OUR SPIRITUALISTIC INVESTIGATIONS

Report on Nino Pecoraro, a Medium, Who Aspired to the $31,000.00 Awards

By JOSEPH H. KRAUS

ON Thursday, April 26, an internationally-known medium, Nino Pecorara, appeared at the offices of SCIENCE AND INVENTION Magazine, at 230 Fifth Avenue, New York City, in what was to be a demonstration of spiritualistic phenomena, in competition for the $21,000.00 prize contest which has been offered for genuine phenomena ever since 1923. He arrived with his manager, Mr. C. E. Davenport, and an interpreter. Awaiting his reception were newspaper reporters of all the papers in and about New York, and photographers and artists on the staffs of those papers. Mrs. Harry Houdini was also present with her manager, Mr. C. Williams, who was prepared to again announce the offer of an additional $10,000.00 to be given to the medium who would bring through the ten words of a message upon which both Mr. and Mrs. Houdini had agreed before his death and which would be the first message to actually "come through" and thus guarantee the authenticity of the sender. Mr. Pecorara had once tried to bring this message through, when he appeared at Mrs. Houdini's home. Present at both this previous séance and the one held on the night in question, was Mr. Joseph Dunninger, whose Magic Department is well known to all of the readers of this magazine. Mr. Dunninger is chairman of the SCIENCE AND INVENTION Magazine Investigating Committee for Psychical Research. The editorial staff of SCIENCE AND INVENTION Magazine was also present.

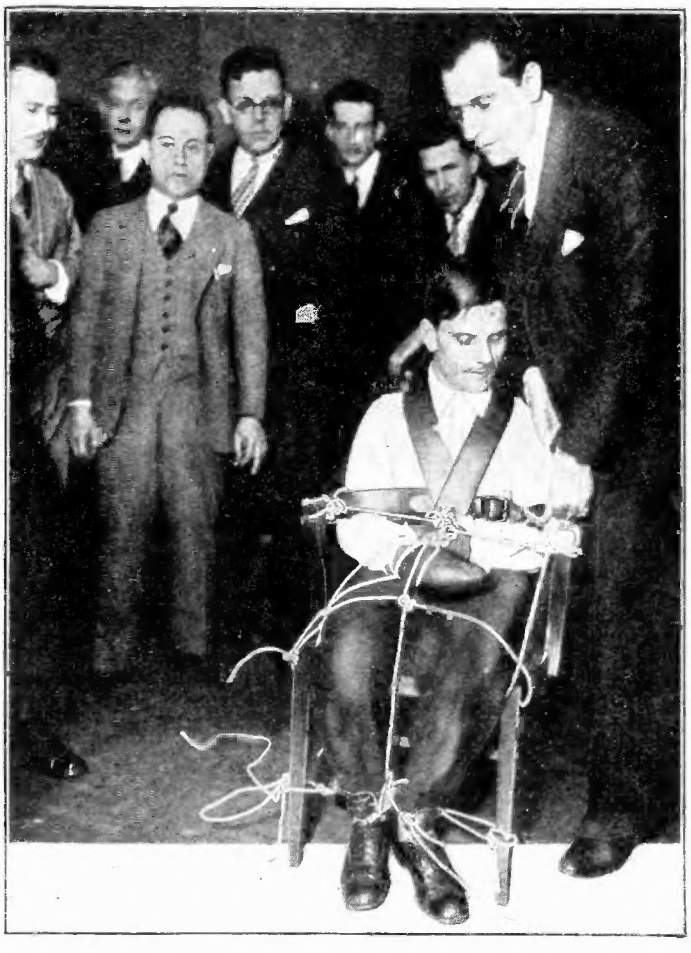
Nino retired into an anteroom, where his clothes were thoroughly examined by a committee composed of newspaper reporters, so as to make sure that he brought no concealed instruments into the cabinet with him. After being dressed in a collarless shirt, trousers, socks and shoes he came into the séance room, in which was gathered the audience to which we previously referred. His hands were covered with two leather gloves, previously examined, and the gloves were then sewed to his shirt by two reporters. A leather harness was then strapped around his chest, as the photographs indicate, and Mr. Pecorara was tied to a chair by Mr. James Cannon, representing the *Daily News;* Mr. Charles Roland, of the *Herald-Tribune*, and Mr. Hal Coffman, of the *N. Y. Evening Journal.*

MEDIUM SUSPICIOUS

THE ropes were tied to the chair, and the knots were sealed with sealing-wax and a signet ring impression left thereon. On several occasions Nino requested the individuals who had been tying him not to tie him so tightly. It was explained at this time that when Nino passed into a trance, his convulsive muscular reactions might break one or two of the seals, but they would not be destroyed to such an extent to excite any suspicion that they had been opened. Nino, bound in his chair, was then picked up and placed in the corner of the room, across which a black curtain had been stretched. On being put in the corner of the room, Nino suddenly observed the door of a practically invisible closet built directly into the wall. His actions concerning what was behind the door were of so suspicious a nature, that it was necessary to open the closet and prove to him that no one was lurking behind the walnut door.

Then followed two short introductions by Mr. H. Gernsback and Mr. Dunninger. In this, Mr. Gernsback warned the reporters who were present that they must not take as complete evidence anything which they see at this séance. The SCIENCE AND INVENTION investigating committee was sitting and observing, and all pledged themselves to be onlookers only, not to make any tests of any nature whatever, nor to interfere with the medium in any way. They agreed not to photograph him unless he gave the signal, and to do everything that was suggested by either the medium or his guides. This promise was kept from the very moment of tying (when the medium requested a little more freedom) to the termination of the séance. In front of the cabinet, made by stretching a curtain across the corner of the room, there was a table measuring about 2½′ x 5′. On this table there were two pails of identical nature, one of which contained hot paraffin and another water. This was for the purpose of producing "spirit" wax hands or molds. Nearer the opposite end of the table there was a pyrex glass dish, filled with modeling clay which had been smoothed down so as to give a perfectly flat surface. This was for fingerprints or other spirit impressions. Near the middle of the table a tambourine was to be found. At the left end of the table, facing the cabinet, Mr. H. Gernsback was seated, and opposite to him was Mr. Dunninger and the writer. Mr. H. Winfield Secor sat in front of the table, with several newspaper men beside him. This position was maintained for the first part of the séance, until the control requested that the Editor, Mr. Dunninger and Mrs. Houdini occupy seats directly in front of the table. In accordance with our promise to do what was desired, this shift was accomplished, thus leaving Mr. Gernsback at one end of the table and the writer directly opposite. Both Mr. Gernsback and the writer could view the curtain from the side, but the only part of this curtain which, if it moved, could be seen, was the lower half foot,

(*Continued on page* 202)



Bound with ropes, knotted and sealed, we show above a photograph of Mr. Pecoraro, as he appeared at the offices of SCIENCE AND INVENTION Magazine. Note the leather gloves and the leather harness. Mr. Dunninger is putting the final touches to the ropes.

Not Even for $21,000 Would Houdini Show Himself at Seance

Five Hours of Delay and Trials Only Brings Palladino's Voice

By Irwin Thomas

Spirit of Houdini Paints Spirit of Houdini, And Is Accused of Being Real Medium

"Handwriting and Was Hand Produced at "Seance"

PRODUCES HOUDINI'S GHOST WHEN MEDIUMS FAIL

MRS. HOUDINI AND SPIRIT OF HER LATE HUSBAND.
While bound in his chair, with sealed ropes, Dunninger produced "ghosts" galore—including one of the late Harry Houdini—as well as fluttering papers, glasses submerged in water, spirit writings and other marvels. The test was conducted in Science and Invention Magazine.

"MAKES" GHOS OF HOUDINI

MAGICIAN MAKES HOUDINI 'TALK' TO EXPOSE MEDIUMS

MAGICIAN BRINGS HOUDINI TO SEANCE

But Medium's Agent Insists the Ghost Is Real and Accuses Dunninger of Physics.

WIDOW IDENTIFIES SCRIPT

And Declares Heard Astral Body Use Ever She Has Been— Mind Reader Tells of Feats.

MAN INVOKES 'SPIRITS' FOR $21,000 PRIZE

Medium Puzzles Jury by His Exhibition; Does Not "Materialize" as Is Required

WITHOUT PENCILS, GHOSTS CAN'T TALK

So Mrs. Houdini Didn't Get Message and Pecoraro, a Medium, Lost $31,000

AND THE MAGICIAN LIKED IT

By Dorothy Dicas

LS TO CONJURE HOUDINI'S GHOST

Goes Into Trance, but ce and Invention Guests wait Miracle in Vain.

PRIZES HIS GOAL

Offers to Do Better Less Time Without Spirit Aid.

SCIENCE IMITATES HOUDINI'S SPIRIT

Magician Startles Widow With Synthetic Ghost.

AN UNRETOUCHED "SPIRIT" PHOTO

One of the most remarkable "spirit" photographs ever taken. Nino Pecoraro was in the cabinet, bound and sealed. The only manifestation which took place was grasping a piece of paper and returning it to the table. The medium's hand is clearly shown. There is no doubt but that he freed himself from his bond long enough to give this demonstration. On the table in the foreground are the cans containing the paraffin and the water, and the dish with modeling plaster. Between the cans are two kerchiefs. The newspaper clippings surrounding show the reaction of the newspaper men to spirits produced by the "medium" and those produced by the "magician." Left to right: Mrs Houdini, Mr. H. Gernsback, Mr. S. Gernsback and Mr. Dunninger.

The clippings surrounding are from the N. Y. Evening Journal, the N. Y. American, the World, the Evening World, the Herald-Tribune, New York Times, the Evening Post, the Evening Telegram, the Brooklyn Eagle, the N. Y. Sun, the Toledo Blade, etc.

Spirit of Houdini Fails to Answer "Medium's" Call

Attempt to Materialize Famous Showman to Critical Audience Declared Complete Failure; Big Prize Is Offered.

SPOOK SEANCE IS FIZZLE, BUT SCIENCE WINS

UNNINGER MAKES GHOSTS ROLL OVER AND PLAY ALIVE

"It's All a Trick," Says Magician After Reporters Gasp at Phenomena Produced to Disprove Spiritualism.

By Dorothy Dicas

MRS. HOUDINI AGAIN WAITS IN VAIN FOR HARRY'S GHOST

Widow of Magician Sits Three Hours with Newspaper Men and Friends, but Nino Pecoraro Fails to Produce Shade

By Earl Sparling

Our Spiritualistic

With ropes tied and sealed, and using substantially the same harness employed by Nino, Mr. Dunninger is being inspected by Mrs. Houdini and Mr. Davenport. Ten minutes after he entered the cabinet, bound in this fashion, phenomena occurred.

illuminated by a dim red light from a lamp on a table six feet in front of the cabinet and reflected from the floor of the room.

At 7:20, the curtains were drawn, and ten minutes later, the acting control of the medium, Eusapia Palladino, started to talk in a mannish falsetto voice. There was no question in any one's mind but that it came from behind the curtain and that it was produced by the vocal chords of Nino. The acting control requested that the lights be turned on so that we could examine the medium again.

It must be remembered that while the room was not totally dark (there being a red lamp lit at all times) the curtain and the space immediately in front of it was as pitch dark as could be. Hence, in order to observe the medium, it was absolutely necessary that the room be lighted. The examination revealed no material change, other than that the medium's hands, formerly tied to his chest, had managed to slip their bonds to such an extent, that they were both resting beneath the cords, but still tied, crossing his lap. Nino was in a semi-cataleptic state induced by a self-hypnosis.

The lights were turned on and off several times; during the entire séance, some voices were produced, which implied nothing spiritual whatever, but which voices continued to give the spectators positive assurance that phenomena would be presented. A voice frequently heard was that of the famous medium, now deceased, Eusapia Palladino, who spoke in Italian, and her words, messages or orders were translated by the interpreter. Another voice was said to be that of the medium's brother; a third, that of the medium himself, and the fourth, the voice of Harry Houdini. The committee as a whole was quite unfamiliar with these various voices, but some of them could have recognized Houdini's voice, if it came through Houdini's voice was far from natural, and was not at all recognized by Mrs. Houdini. All the voices sounded like the medium himself. Mr. Dunninger and Mrs. Houdini were requested to stand and hold hands, and the photographers were told to get ready. At the signal of 3, the flashlight picture was to be taken.

PAPER FLUTTERS

AT 9:05, a piece of paper on which four names had previously been written was picked up from the table and carried through the curtain. At the signal, given by the *spirit guide,* the photographers were permitted to photograph the scene, when the paper was being rapidly moved through the air, by what was supposed to be spiritual power. This picture is reproduced in this publication. It was taken by a *New York Evening Journal* photographer.

THE MEDIUM'S HAND?

IT will be observed that the hand of the medium is clearly discernible in this photograph. Consciously or sub-consciously, the medium was able to slip out of his bonds to such an extent that he could grasp this paper. The flashlight was probably too rapid for him, because it shows the medium's hand in clear detail. We wish to impress here that the part of the picture of the hand and the paper here shown has not been retouched in any way whatever. The details, which always lose something through reproduction, are perfectly clear.

NO FURTHER MANIFESTATION

MADAME PALLADINO repeatedly assured the audience that there would be more phenomena. She promised wax hands, impressions in the plate, table raps, tambourine sounds; she promised to materialize the spirit of Houdini and produce his handwriting on the sheet of paper. Not one of these repeated promises was kept. The only manifestation that was produced in five hours was the piece of paper waved around in the air and a pencil being accidentally dropped on the floor. Hope ran high.

There were no further manifestations, so at Mr. Davenport's suggestion, the meeting was terminated at 9:28. The newspaper men were sadly disappointed. After five hours, they expected to see more than a paper flashing in the air. Phenomena were repeatedly promised by the medium and by the various spirit guides. The newspaper authorities were unanimous in their verdict that on this particular occasion the spirits had completely fooled them by their unwillingness to produce results, even as they had on the previous occasion at Mrs. Houdini's home. Newspaper clippings surrounding the photograph of the manifestation (?) attest to the news' reactions.

The spectators further agreed, that the following Thursday, at the same time, they would be willing to view "Dunninger's" doing some of the so-called spiritualistic phenomena by perfectly natural and scientific means, held under similar conditions and circumstances, which "Dunninger" agreed to demonstrate.

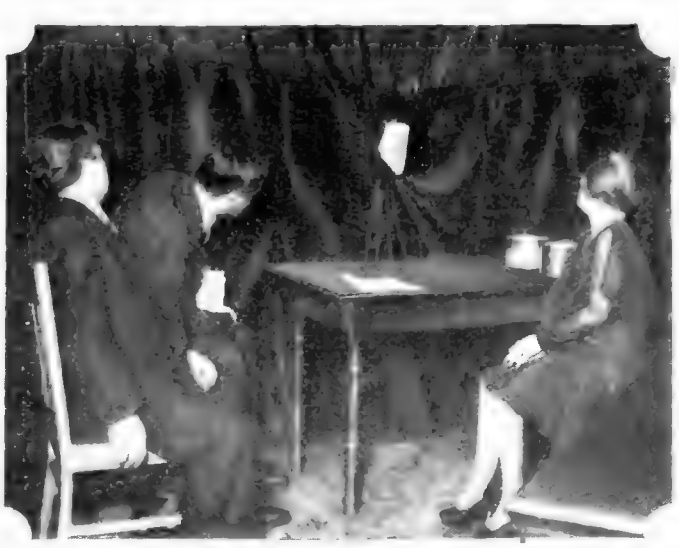
Nino's bonds were examined at the termination of the séance and several seals were found to have been broken. It might also be interesting to point out that while Nino claimed he did not at any time try to escape from his rope ties, a photograph taken of him while at Mrs. Houdini's home shows clearly, that even though apparently securely fastened to the chair, he was able to raise his hands as high as his face. And there is no question but that the hand was released in this case. This photo forms an interesting illustration in this article.

Had this first séance produced anything of value, SCIENCE AND INVENTION would then have requested Nino to sit again in the magazine's laboratory, with the special instruments that would have been devised for the purpose of testing the reactions. It is necessary to first see what the medium can do before one can possibly suggest scientific means of measurement or control. It was unanimously agreed by the witnesses and by the committeemen that this demonstration was a fizzle as far as spiritualistic phenomena were concerned.

HOW OUR SENSES FOOL US

IT was during the first half of the séance that Mr. H. Gernsback asked this writer, who was seated at the opposite end of the table, whether he saw a hand move across the table. The answer was that no such hand was seen. Bear in mind that this occurred quite some time before the paper had been removed from the table. Subsequently, the editor-in-chief, in a conference with the other members of the staff, informed us that the eyes certainly do fool a person when he is in the dark or in semi-darkness. Mr. Gernsback could see, according to his own admission, the reflection on the tambourine and the reflection on the edge of the cans containing the paraffin and water, but his eyes would become so fatigued by constantly staring at these objects in the very dimly lighted room that they finally disappeared. It was necessary for him to close his eyes or shift his gaze to a different object, in order to make the one that had vanished come back to complete visibility again.

As the paper was being lifted, Mr. Gernsback pointed out that a pencil had fallen to the floor. This actually occurred, but the

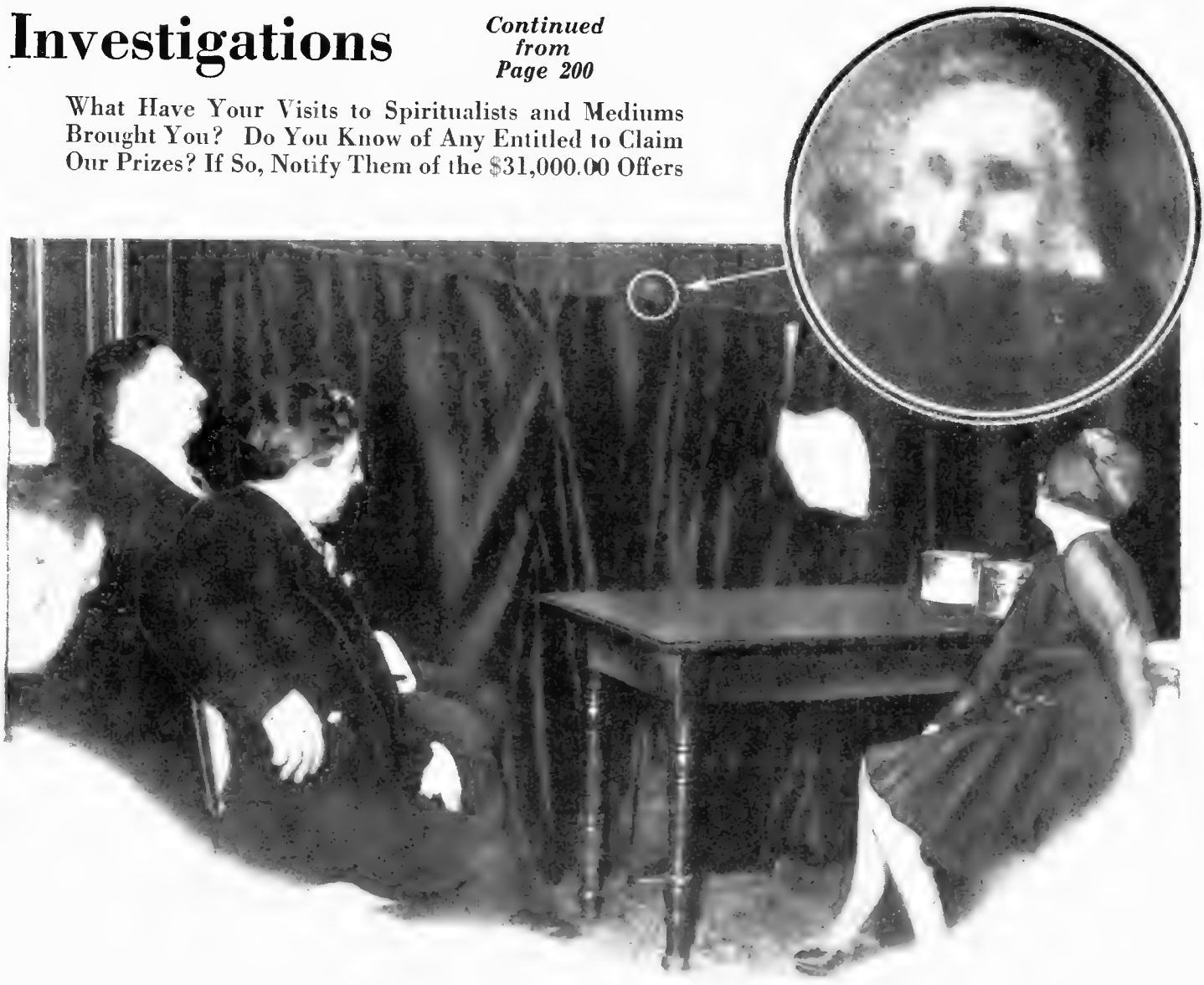


Dunninger materializing the ghost of Harry Houdini. This is a flashlight photograph taken during the séance. Observe the likeness to the great magician. Left to right: Mr. C. E. Davenport, Mr. H. Gernsback, and Mrs. Houdini. On the table stand the two pails, one containing paraffin and the other water. Note the paper on which a signature later appeared. It is fully four feet from the cabinet.

Investigations

Continued from Page 200

What Have Your Visits to Spiritualists and Mediums Brought You? Do You Know of Any Entitled to Claim Our Prizes? If So, Notify Them of the $31,000.00 Offers



This photograph shows a piece of paper being wafted around in the air by natural forces. It indicates that Mr. Dunninger is doing the trick even better than the medium performed the operation, in that the hand cannot be observed. The photo shows something phenomenal. On the curtain, a head can be made out. An enlarged view of this head appears in the upper right-hand corner. This is a freak condition due to the reflection of the flashlight on the curtain's background. Many a medium would attribute the result to "spiritual force." Left to right: Mr. H. Gernsback, Mr. Davenport and Mrs. Houdini.

reason it happened was because the spirit or whatever it was, could not find the pencil on the table. This writer had long since discovered that an object can be located in the dark if on a table by purely a sense of direction and muscular control.

IN THE DARK

FOR example, if a person should fix in his mind the position of objects lying on the table, and the room is suddenly darkened, that person can still reach for the object and will undoubtedly find it very readily. A room illuminated by a faint red light seems to be enveloped in stygian blackness the instant any overhead lights are extinguished. At this point a medium can easily and quickly grasp for an object on the table and produce his manifestations, without being afraid in the least that he will be caught in the act. Giving the medium every credit for reasonable doubt, the medium could reach the table, grasp the pencil, and sign a name to the paper before the spectators in the room became accustomed to the red light; and before they were able to distinguish objects in the séance room. Accordingly, every time the main lights were turned out, this writer changed the position of the pencil. This made it necessary for the medium (if the medium is operating fraudulently) to grope in the darkness for a pencil, with a possible chance that the pencil would be knocked off the table; but in any event a positive assurance that by the time the pencil was found, the medium would have been observed.

If an *ectoplasmic* or *spirit hand* came forward to grasp the pencil, it would make no difference how long it took to find it. There is no reason why the ectoplasmic hand should rush back behind its black curtain, when no one in the room would have made an attempt to grasp it, and when the medium was given every possible opportunity of demonstrating his power.

But the point which the writer wishes to bring out is that in spite of the fact that he shifted the pencil every time the room was thrown into darkness again, after being first flooded with light, not one person in that entire room observed that the pencil was shifted.

THE MEDIUM'S LETTER

ON April 28, Nino Pecoraro sent the following letter to Mr. Dunninger and the press:

"I am writing this letter to you both as a protest against the grossly unfair treatment I received at your hands and those of the Press in judging the results of the séance held at the editorial rooms of SCIENCE AND INVENTION *on Thursday, April*

(*Continued on page 262*)

$31,000.00 FOR SPIRITS

$1,000.00 was offered by this publication in the June, 1923, issue for spirit manifestations that could not be duplicated or explained by scientific means.

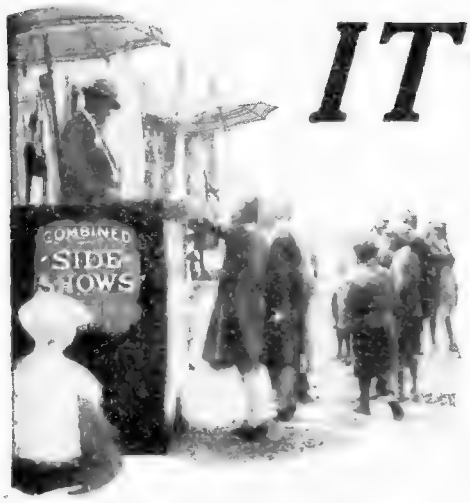
$10,000.00 for spiritual phenomena was offered through SCIENCE AND INVENTION by Joseph F. Rinn in the August, 1923, issue.

$10,000.00 was offered through SCIENCE AND INVENTION Magazine by Joseph Dunninger for spiritual manifestations which he could not explain or duplicate by scientific means under identical conditions.

$10,000.00 is now offered through this publication by Mrs. Houdini for the ten-word message which Houdini promised to deliver.

TOTAL: $31,000.00 for spirit manifestations.

IT'S ALL BUNK



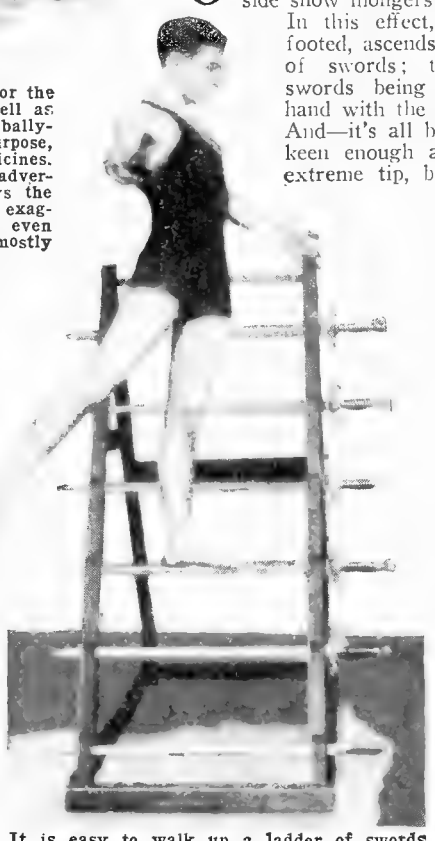
There is an all-year-round reason for the side shows of the circus lot, as well as those side shows which are used to ballyhoo for a crowd required for any purpose, from the selling of books to medicines. Everything painted on the canvas advertising the side show is not always the unadulterated truth. The canvas exaggerates a little, but the artists do even more than that. Their system is mostly one of bunk.

SIDE shows come and side shows go, and the BUNK goes on forever! Pure bunk; for although some of the "strange, strange people" on exhibition are actually freaks, the greater percentage of side show acts are nothing more nor less than plain applesauce!

THE SWORD LADDER

ONE of the many acts performed by these side show mongers is The Sword Ladder. In this effect, the performer, barefooted, ascends and descends a ladder of swords; the sharpness of the swords being demonstrated beforehand with the usual hair-cutting test. And—it's all bunk! The swords are keen enough at the hilt and at the extreme tip, but the center portions are so dulled that the performer can ascend and descend in perfect safety. Even rather sharp swords are comparatively safe to hardened feet, if the performer takes care not to slip sideways.

A is a holder for the test tube, B, a tank of gas, and C, a rubber tube connecting the two. The gas is a developer for a fortune, written in sympathetic ink.



It is easy to walk up a ladder of swords when the center of the blades is dull.

THE PETRIFIED LADY

DID you ever see the Petrified Lady? According to the side show barker, she is a real human being who has gradually turned to almost solid rock, Petrified! Yet she breathes quite naturally, and froths at the mouth occasionally for the benefit of the cash customers. The secret of this bit of chicanery is absurdly simple. The figure is merely a life-like wax figure, made to breathe and spit by means of an ingenious electrical mechanism which is controlled from underneath her "death bed." The cloth chest moves up and down by a sort of bellows action.

FAKE SIAMESE TWINS

ANOTHER common fake is The Siamese Twins. There are real Siamese Twins, it is true, and an interesting report on them appeared in the March issue of this publication, but those are not the ones that probably live in your memory. The ones you saw were undoubtedly a fake; simply and easily made by fastening two ordinary twins or girls who looked nearly alike together by means of a double belt of flesh-colored rubber.

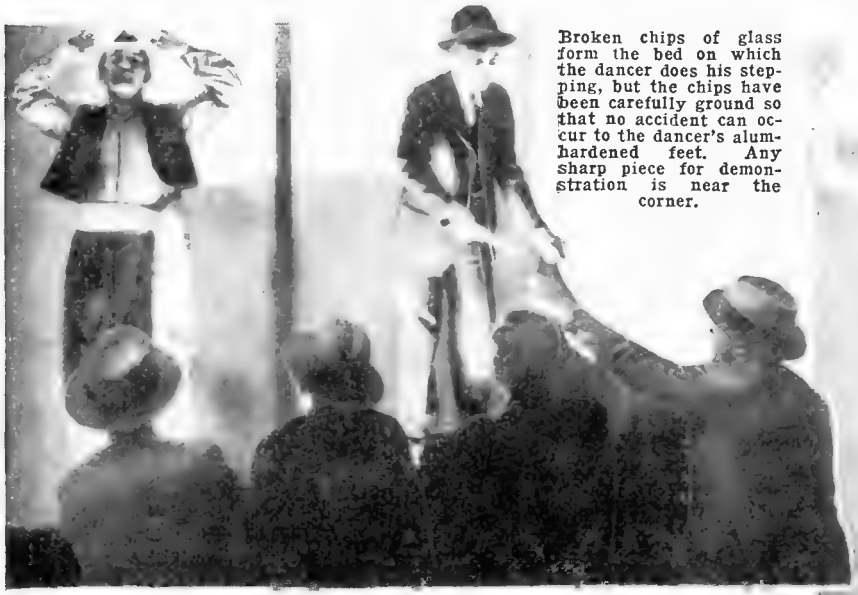
THE STRONG MAN

THE Strong Man is another standardized side show act. One of his specialties is the famous "rock breaking test." In this he allows a huge rock to be broken on his unprotected chest, an assistant using a large sledge hammer for this purpose. It looks wonderful to the layman, but . . .

Did you ever hold a brick in your hands and break it with two or three light taps with a hammer? Did it hurt your hand Of course not! The inertia and density of the brick absorbed all shock long before the blow reached your hand. The brick cannot transmit the force of the blow instantly. It works the same on a larger scale—the blows, though quite powerful, are absorbed by the large rock, and their force reduced to a minimum.

Another popular trick of the modern Hercules is the famous "Nail Driving" effect. In this demonstration, the disciple of Samson drives several large spikes through a double thickness of two inch planking, using nothing but his hand, wrapped in a handkerchief, for driving power.

The feat has every appearance of



Broken chips of glass form the bed on which the dancer does his stepping, but the chips have been carefully ground so that no accident can occur to the dancer's alum-hardened feet. Any sharp piece for demonstration is near the corner.

How the mystic tells fortunes is revealed by the two photographs above and the diagram on this page. A piece of paper is torn from a pad. This piece is apparently blank when superficially examined. The mystic then rolls the paper into a tube, and places this into a test tube which he holds between his fingers and against his forehead. When the paper comes out, a fortune appears thereon. The proud possessor has paid 10c for a demonstration of a simple chemical stunt. The gas in the test tube "develops" the sympathetic ink writing.

How an Unsuspecting Public is Being Bamboozled by Fraud and Trickery

By SAM BROWN

being the real thing, and, in many cases the strong man actually does the effect legitimately. The less powerfully endowed Samson, however, resorts to trickery in order to make this performance possible. The boards through which he drives the spikes are prepared in the manner shown in the diagram, beside the photographic illustration so that a moderate smash is all that is necessary to send the spike completely through the weakened plank. The edge of the faked joint is made quite indetectable through the application of beeswax and fine sawdust.

THE GLASS DANCER

THE Glass Dancer is a feature which is parallel to The Sword Ladder. In this number, the performer dances in a bed of broken glass without injury. It looks dangerous; but the glass is really quite dull; not at all sharp enough to cut the alum-soaked feet of the performer. The sharp pieces of glass that are removed and demonstrated to the audience, are taken from a corner, where they never can fall under the dancers feet.

THE FORTUNE TELLER

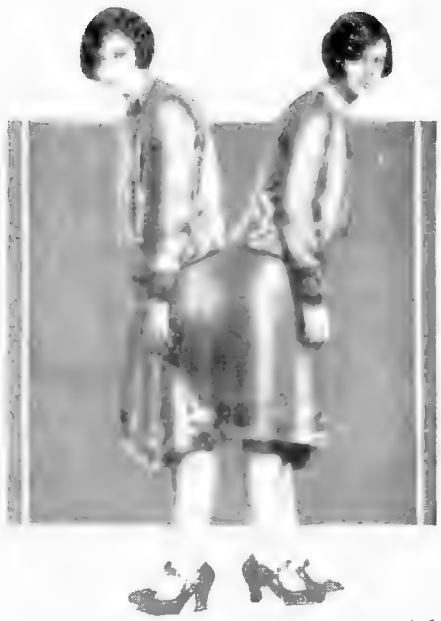
AMRAH, The Hindoo Fortune Teller is another lot of hooey! He places plain, white sheets of paper in a test tube, and—Lo!—the spectator's fortune appears on the blank sheet! Of course, the chemist made Amrah's stunt possible. The fortunes are previously written on the blank sheets of paper with sympathetic ink. When this ink comes in contact with the proper chemical agent, the invisible writing is developed and the fortune appears. The diagram on the lefthand page shows how the fortune teller secretly gets the chemical gas into the test tube without detection—the tube is merely dropped into his pocket when not in use, and a gentle arm pressure forces the gas from a bag into the glass tube.

THE HANDCUFF KING

AND, of course, the Handcuff King. In one of his numbers, he allows himself to be handcuffed and then nailed in a heavily-constructed and seemingly unprepared chest. The committee then places the chest with its human cargo behind the curtain, and a few minutes later—Lo!—there stands our hero, out of the chest and the handcuffs, although both of these are found in the same condition as at the beginning of the experiment.

Easy pickings for the Handcuff King! The chest is his own and a side panel is not nailed into place, but merely wedged into the opening and held in place with two concealed pins. To effect his escape, the "Wonder Man" need only crawl out through this faked panel and then replace it in its original position.

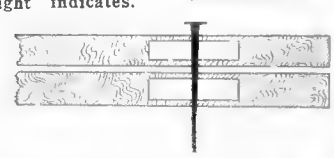
And what about the handcuffs? Easy! Most ordinary handcuffs—Bean, Romer, Tower, Premier—are controlled by a single-action lock which can be as easily opened with a pick made from a piece of watch spring as they can with the regulation keys. This pick the performer has tied around his waist, and once inside the chest he proceeds to use it to effect his escape.



These Siamese twins can be easily separated. As a matter of fact, they are always separate, except when on exhibition, when a flesh-colored elastic bandage joins them, as the photograph indicates.

Yes, stones are actually broken on the chest, but anyone who can hold the stone can permit of having the experiment tried on him. The strong man experiences but very little shock from the blow of the hammer, the force of which is dissipated by the mass of the stone.

Some strong men use "regular" lumber for this nail-driving experiment; others hollow out a portion of the wood, as the diagram at the right indicates.

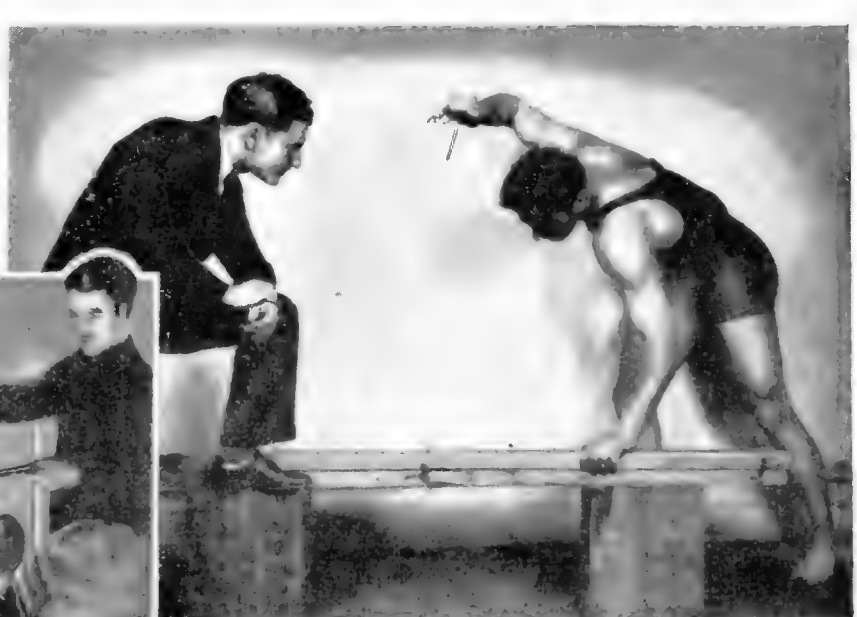


THE PERPETUAL MERMAID

GRIM, in his colorful book of fairy tales, tells of

(*Cont. on page 265*)

The "stone lady" on exhibition. She breathes, but is lifeless. We are told that she is turning to solid stone by a peculiar unknown disease.



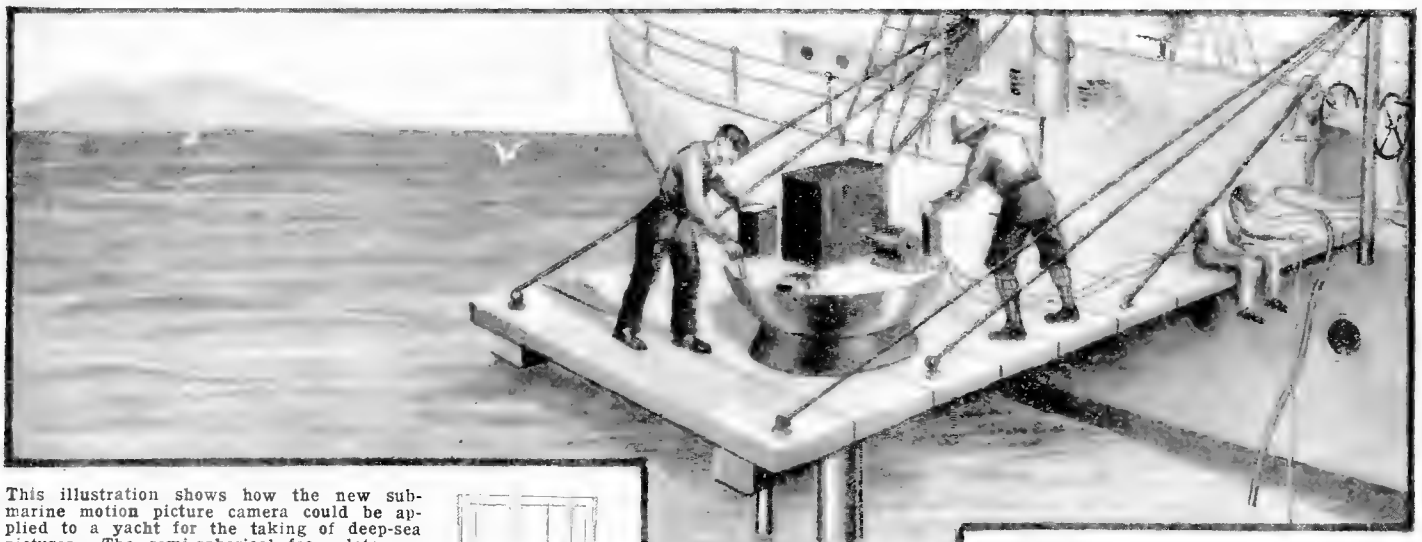
A nail can be driven through a wooden joist or two joists can be nailed together in the manner here indicated. The nail is first wrapped in two or three kerchiefs, so that there is little possibility of injury to the palm of the hand. A smashing downward blow will send it through the wood.

At the left, the stone lady is found to be made of wax, and the undulating chest movements, indicating breathing, are performed by bellows located under the cloth.

Deep-Sea Motion Picture Camera

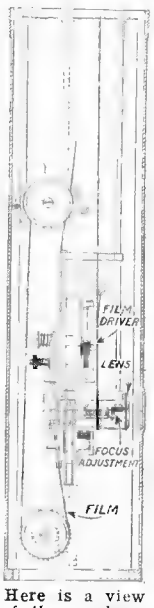
The Film Boxes Are at the Surface, But a Tube Carries the Film to the Lens Located Near the Bottom

By H. WINFIELD SECOR



This illustration shows how the new submarine motion picture camera could be applied to a yacht for the taking of deep-sea pictures. The semi-spherical face plate can be rotated or moved to any angle to follow the actors.

A CALIFORNIA movie concern has recently become the possessor of the unique invention of Paul Guerin, by the aid of which we can expect some very unique motion pictures from this famous company, which has specialized in "bathing beauty" productions. This invention relates to motion pictures cameras for taking "movies" beneath the surface of a body of water. The same device can also be used for taking photographs from an airplane or a boat. Thus, if the cameraman wants to take a picture of a speeding boat as though he were directly behind that boat, he could do so even if fifteen or twenty feet to one side thereof. As will be observed, the system consists of a long, tubular barrel of any length, regulated by inserting extra sections. There are gaskets between the fittings to prevent possible seepage of water into the barrel itself, and at the bottom, a weight is located to maintain the tube in a substantially upright position. This tube connects at its upper end with a semi-spherical face plate, movably mounted in a semi-spherical socket, thus making a ball and socket form of universal joint. Paralleling the tube there is another tube which serves as the finder. At the bottom of this second tube a lens and mirror are located for the purpose of projecting up to a ground glass, any scene which may take place at the distant end of the tube. It will be further seen by examining the drawing, that the film boxes are mounted upon the face plate which in turn is supported by a platform projecting from a yacht. The film-driving mechanism is operated by an electric motor.



Here is a view of the mechanism at the bottom.

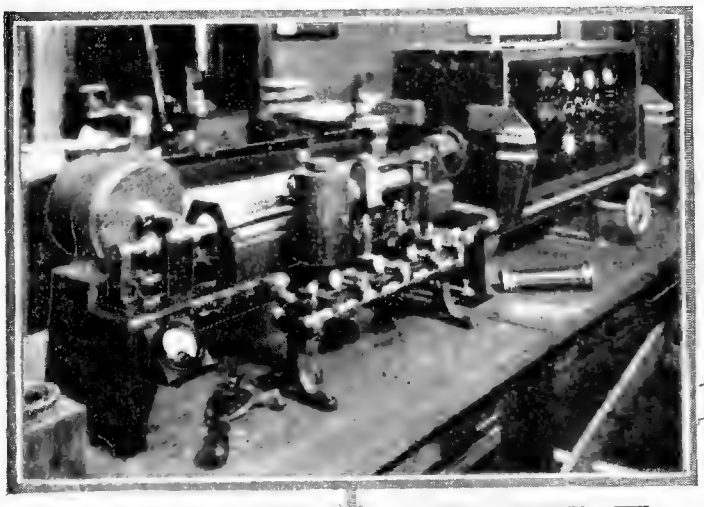
Thus, the cameraman needs but turn on the current and photograph whatever appears below, because the lens of the camera is mounted just in back of a window provided in the first mentioned tube. Any focusing which the cameraman has to do is done at the surface where the cameraman turns a shaft to register a finger with the proper distance marking on a scale. The operator also looks into the finder tube and rotates the member, or if necessary, tilts the barrel so as to throw the image of the scene

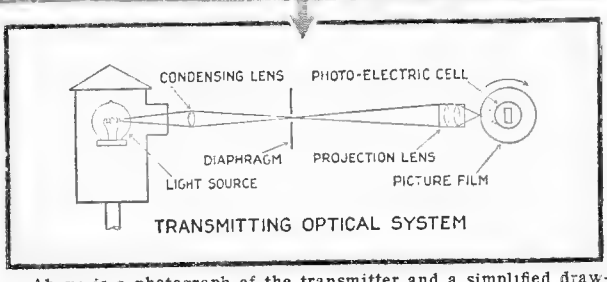
(*Continued on page 268*)

The tube-like member at the left permits the film to be carried down to the lens just behind the window near the bottom. A finder is located alongside the lens and reflects its image to a ground glass at the top.

Movies via Telephone Wire

Pictures Transmitted from Chicago to New York Exhibited Within Two Hours

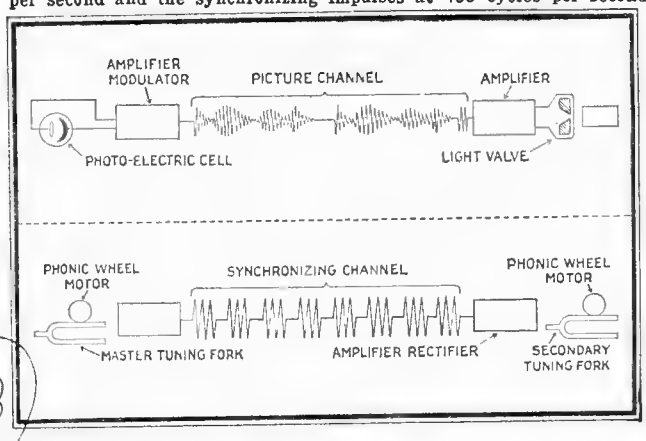


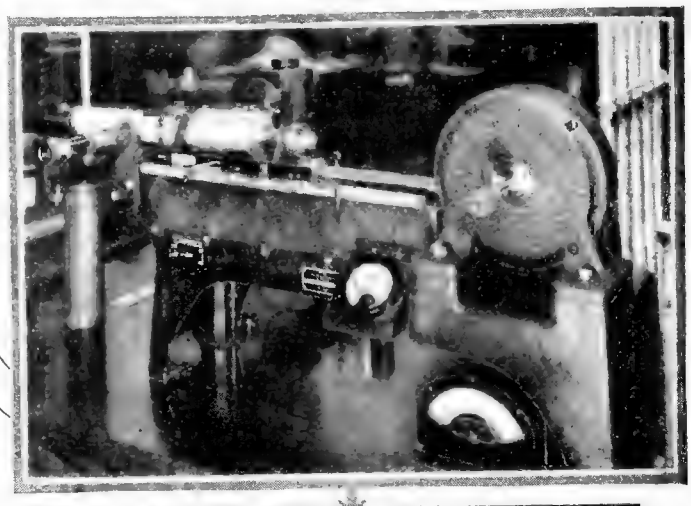


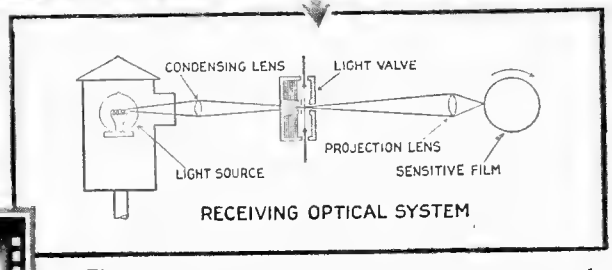
Above is a photograph of the transmitter and a simplified drawing of the optical system used. By means of this arrangement, a small spot of light is projected upon the picture.

.—Photos courtesy American Telephone and Telegraph Co., Telephoto Dept.

Below is a schematic representation of the picture and synchronizing currents. The picture is sent on a carrier frequency of 1,300 cycles per second and the synchronizing impulses at 400 cycles per second.





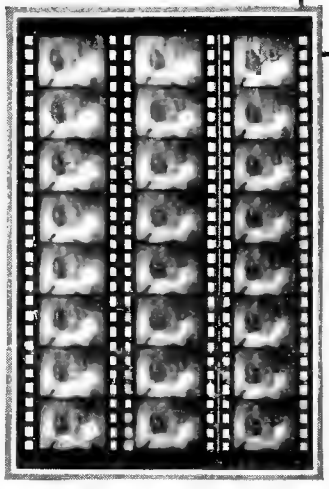


The receiver and receiving end optical system appear above. Incoming current passes through the light valve, varying the aperture and thus the light intensity.

MOVING pictures by wire are now made possible by recent developments of the American Telephone & Telegraph Co., as was demonstrated recently when a movie strip of Vilma Banky was sent from Chicago to New York and exhibited at the Embassy Theatre within a few hours' time. Three sections of the film were pasted side by side in order to make a picture approximately 5" x 7", for rapid transmission. The speed of transmission for a picture of this size going through telephone circuits is about seven minutes. The photographic processes at both ends, however, are actually the most tedious. Therefore, about an hour or more is required before the finished product is ready for delivery.

The principle involved is not as complicated as it would seem. A 5" x 7" transparent positive is mounted on a drum which revolves and at the same time moves slowly from side to side. Its lateral speed is one-hundredth of an inch per revolution, and determines the number of vertical rows of impressions made. A spot of light is focused through the revolving positive which is being transmitted and falls upon a photo-electric cell. This cell passes a current which varies as the intensity of the light which plays upon it. Thus, when solid black appears on the positive, it shuts off the light and a very small current flows through the cell. Where the positive is transparent, considerable light passes through the cell and a large current flows. This fluctuating current is amplified and then passed through the telephone lines to the receiving point. Here it is again amplified and used to control what is known as a "light valve." This is a magnetically operated shutter of extreme sensitivity which controls the beam of light passing through it. This beam plays upon a cylinder of the same diameter and revolving at the same speed as that at the transmitting end.

On the cylinder is an unexposed photographic film which becomes the negative from which the prints are made. The motors used in the transmitting and receiving apparatus must be perfectly synchronized. This is accomplished by means of synchronizing impulses which are super-imposed upon the line which carries the picture currents. In order to do this, the picture is sent on a carrier frequency of 1,300 cycles per second, and the synchronizing impulses on a lower frequency carrier of 400 cycles per second. Both of these lie in the range of frequencies transmitted by any telephone circuit. The two currents are kept separated by a system of electrical filters at the sending and receiving ends, so that while the current on the line consists of a mixture of the two modulated frequencies, the appropriate parts of the receiver receive only one carrier frequency each. The means employed for synchronization in the present apparatus consists of impulse or phonic wheel motors controlled by electrically-driven tuning forks. This makes it possible to produce an accurate copy of the original picture by keeping the two cylinders rotating at a uniform rate. Both of the cylinders are 6 inches in circumference and revolve 1½ times per second. Twenty-six hundred images are flashed over the wire circuits each second. All electrically-transmitted pictures have, as a result of the scanning process at the receiving and transmitting ends, a certain amount of structure. The movie strip shown here shows the fineness and character of this structure upon which the detail depends.



Above is an unretouched picture of a movie strip of Vilma Banky which was sent from Chicago to New York over wire recently. Three strips were pasted side by side.

Phoney Inventions

A Brand New Means for Entertaining

By HUGO GERNSBACK
Member American Physical Society

With this book you cannot possibly fall asleep. The instant that it is allowed to rest on any object, it buzzes loudly until again lifted.

UNDER this heading we shall continue the department known as *"Phoney Inventions."* This is a brand new means for entertaining your friends. It is exceedingly useful for home parties and club gatherings. Anyone handy with tools can make a Phoney Invention. The principle of this new entertainment is to have a ridiculous device that gives unexpected results or that is otherwise mirth-provoking. Anyone can make one of these contraptions in his spare time.

SCIENCE AND INVENTION will pay $5.00 for every Phoney Invention submitted to this department and accepted for publication. full description of the invention, with drawings and photographs accompanying the same will be published in this Department. If photographs cannot be supplied, the device may be sent to the Editors for their inspection, after which it will be returned to the maker. Address all correspondence to Editor, Phoney Inventions.

IN the June issue of SCIENCE AND INVENTION, I disclosed a brand new means for entertaining, three mechanical devices, which we have termed for lack of a better name "Phoney Inventions." As I explained in that issue, the test of one of these foolish inventions should be to positively produce a laugh when it is demonstrated. If it does not do so, it does not fall in the classification of "Phoney Inventions."

As I also explained in the June issue, these ridiculous inventions are used particularly during gatherings, dinner parties, and amateur theatricals, and if mirth-provoking enough, they will give rise to a lot of innocent and harmless fun.

YOU CAN'T SLEEP WITH THIS BOOK

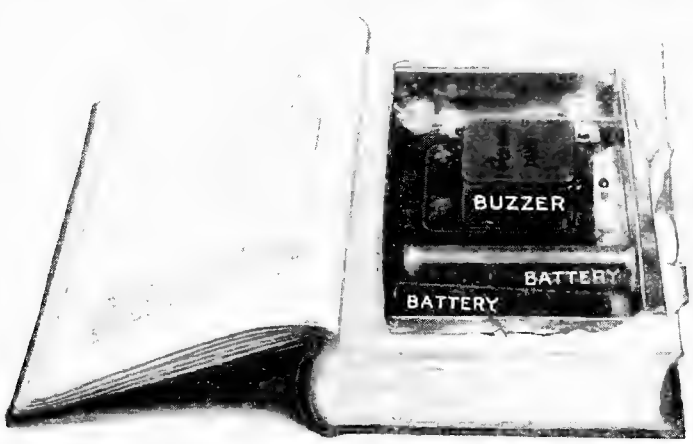
IN this last instalment, I have shown three further inventions, which were actually gotten up by me sometime ago, all of which having proved quite successful from the standpoint of creating a great deal of amusement.

The first one, described in these pages, is an innocent-looking book. You produce this book and explain to your audience that the trouble with authors nowadays is that it is difficult to provide a book that holds the reader's interest throughout; and sooner or later, he will fall asleep over the average book when the plot unthickens or unloosens. That positively cannot happen with the present invention, for it is impossible to fall asleep over it or with it. You then proceed to demonstrate how impossible it is to actually fall asleep. You begin to close your eyes, your arms relax and the book descends on your lap and comes down on your leg—when lo and behold, a loud noise is suddenly heard, and you wake up with a start.

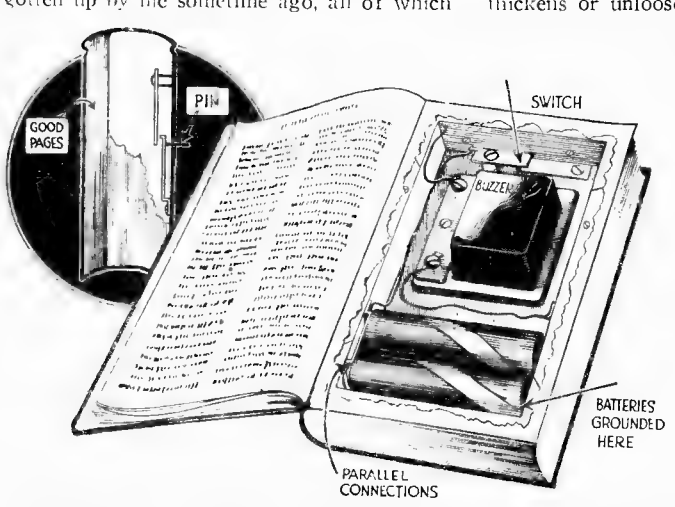
The secret is within the book, and the illustrations show this. A pin contact goes through the back cover, which makes the usual contact. There is also a buzzer and two flashlight cells, all contained within the book. The instant the contact is established, the buzzer goes off with a loud sound, which causes you to raise the book. The instant the weight is relieved, the contact is broken and the book becomes silent once more.

The best way to duplicate this effect is for you to get an old book, for which you have no further use, and which should be some sort of a dry volume on Economics or some other subject of a technical nature, which can be bought cheap enough in a second-hand store. All you have to do then, is to carve out the inside, as shown in the illustrations, which can be done with a safety razor or an ordinary sharp knife. The leaves are then glued together, so the rear part of the book cannot be opened.

Most of the room is required, of course, for the battery and the buzzer. About twenty pages or so are left in the front of the book, which leaves are not touched. One page is then glued down to cover up the buzzer and the battery and you will be surprised to see how innocent looking the book is after the work is completed. Of course, you will have to destroy one page if you



The photograph above shows the internal construction of the "Phoney Invention" book. The latter half of the volume has been cut out so as to compactly contain two batteries, a buzzer and a switch. The instant that the book is rested on the surface of any object, or when the book is laid down, the switch closes the circuit through the batteries and the buzzer awakes the sleeper with a start.

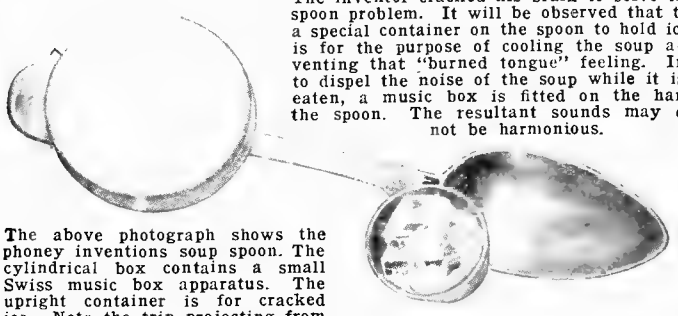


The diagram above explains the principal part of the construction of the "Phoney Invention" book. Note the position of the buzzer and batteries. Also observe how the pin extends from the back of the book and aids in closing the contact through the switch.

open it up and renew the battery, but there are enough pages left anyhow. If this "Phoney Invention" is brought before your friends with a fair amount of good "patter," it will never fail to produce a big laugh.

REFRIGERATED MUSICAL SOUP SPOON

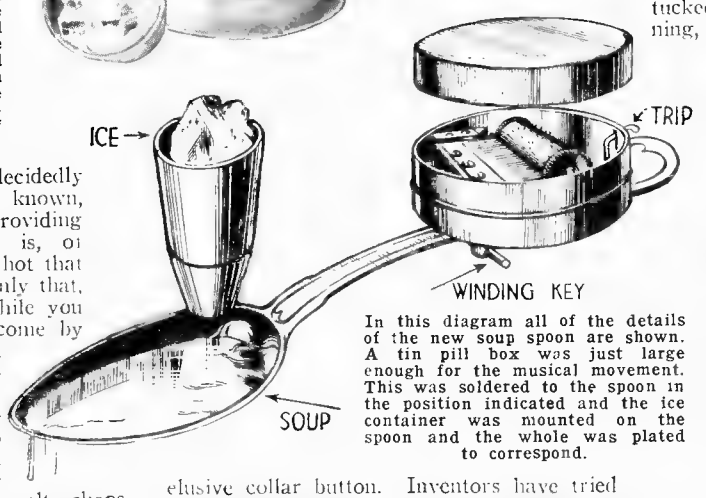
THE next invention might be called "The Refrigerated Musical Spoon." Here is an invention that has long been wanted.



The inventor cracked his brain to solve the soup spoon problem. It will be observed that there is a special container on the spoon to hold ice. This is for the purpose of cooling the soup and preventing that "burned tongue" feeling. In order to dispel the noise of the soup while it is being eaten, a music box is fitted on the handle of the spoon. The resultant sounds may or may not be harmonious.

The above photograph shows the phoney inventions soup spoon. The cylindrical box contains a small Swiss music box apparatus. The upright container is for cracked ice. Note the trip projecting from the handle of the soup spoon. The music box further serves to balance the spoon when it is full of soup.

Something has always been decidedly wrong with soups as far as is known, even in the days of Adam (providing he ate soup). The trouble is, of course, that soup is usually so hot that it burns your mouth, and not only that, but it makes a lot of noise while you eat it. All this is now overcome by this illustrious invention. An ordinary soup spoon is provided at one end with a metal receptacle, in which cracked ice is placed. This is soldered to the spoon. On the handle end, there is a small miniature music box, which can be obtained in novelty shops. You provide the spoon with ice, and then demonstrate it to your friends during dinner. The ice cools the soup spoon sufficiently to cool even the hottest soup; at the same time, while you lift the spoon up to your mouth, you press a little trigger and the music starts. This effectually hides the "music" which you usually produce while you eat the soup.



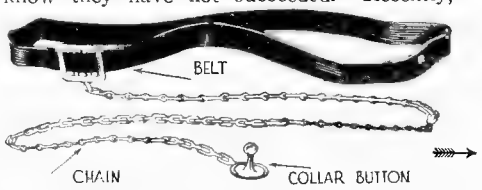
In this diagram all of the details of the new soup spoon are shown. A tin pill box was just large enough for the musical movement. This was soldered to the spoon in the position indicated and the ice container was mounted on the spoon and the whole was plated to correspond.

The combination is most charming and I see a great future for it. I admit it's a bit cumbersome and you have to be careful when you clean the spoon, because with the music box attached to it, you cannot immerse it in hot water; that might silence it forever, so you will have to give it special attention. All in all, this invention never fails to produce a good laugh and great merriment.

COLLAR BUTTON YOU CAN'T LOSE

THE final invention, also shown here, is one which every man has been looking for, for countless ages. I am greatly surprised that no one has thought of it before, but then all great inventions are terrifically simple. Just think of the safety pin, the rubber eraser at the end of your pencil, et cetera.

We all know the elusive collar button. Inventors have tried to produce one that can't be lost. We all know they have not succeeded. Recently, an inventor suggested the use of fly paper at the end of the flat end of the collar button, but the suggestion was not taken seriously by anyone. Another one suggested the use of a small radio inside of the collar button so if it did get lost, it would send out its own S.O.S. That was perhaps the cleverest invention of all. There was, however, only just one hitch to it, and that is there was no radio apparatus quite so small to put inside a collar button, so that idea had to be given up.



A "Phoney Inventions" collar button is being put into a shirt. The belt encircles the body. Inasmuch as the chain is soldered to the buckle and the button to the chain, it is impossible to lose this collar button.

Knowing all these defects, I finally produced a collar button to which there is no objection, and that POSITIVELY cannot be lost. As a matter of fact, the most difficult thing about this particular collar button is that it will take a great effort to lose it, and as I stated before, the invention is ridiculously simple. It comprises, as the illustration shows: A collar button, to which is attached four feet of strong brass chain. The end of this chain is attached to a rubber elastic belt, which goes around the waist. That belt is important, because without it, you might possibly lose the chain and the collar button, but once it is anchored safely amidships, as shown in our illustrations, there is no chance for this. Of course, the chain is worn underneath the shirt, and tucked neatly out of the way. In the evening, you unbuckle the harness and you are all set for the next day. If the button does fall down, the chain goes with it and so does the belt, but you need not worry, because it is too large to be lost.

As the illustrations show, the collar button is of the ordinary variety. A good brass chain is soldered to the back of it, and the other end of the chain goes to the belt. If this invention is produced before your friends with "patter" similar to that just mentioned, it will never fail to produce a great laugh. Of course, the idea is to make a long, important sounding talk before you actually produce the collar button, and it is also a good idea to take off your collar and give a demonstration of how it works in practice.

I hope that these examples have set our readers to thinking, and I hope that we shall publish many of these "Phoney Inventions" during the coming year.

A photograph of the phoney invention collar button which positively cannot get lost. It is shown in use at the right.

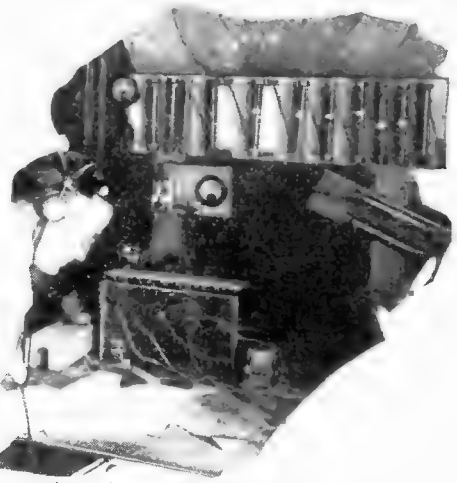
A "Phoney Inventions" collar button is shown above being soldered to a chain which is long enough to reach a buckle; the buckle in turn, being fitted to a belt.

Scientific

A Photographic Picturization

It is almost impossible to keep up with the rapid strides taken in the field of science. This is truly a scientific age.

Above is a real "flying boat," owned by Malcolm Hope. The craft employs an outboard motor, and apparently must have been going at a terrific speed in order to leap out of the water as shown in the photo.



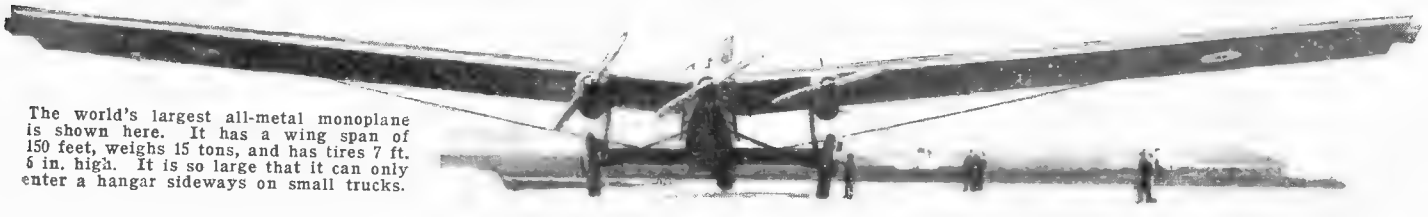
To the left is a view of a new model piano which employs a delicate tracery of spars instead of the conventional legs. The designer also suggests the elimination of the conventional piano case.

The above photo shows Dr. William R. Whitney, in the laboratory of the General Electric Co. He is the inventor of a machine which will read books aloud. The device will undoubtedly be a great boon to the blind.

A new machine which is capable of making quantities of photographic prints in a short time is now being used in preparing thousands of pictures of "Al" Smith for his coming sampaign.

George H. Lutz is shown above with a new mirror for telescopes made of a special metal alloy four times as hard as steel. One of the principal advantages of the new reflector is its durability, whereas the silvered mirrors now in use must be removed every few months.

A new German invention, a collapsible rubber life-boat, is shown above. The boat will hold twenty persons, and is propelled by a four horsepower motor, as well as being fitted with a mast, sails and oars. It may be inflated by a pump or bellows. Herman Meyer, the inventor, is shown operating the bellows.



The world's largest all-metal monoplane is shown here. It has a wing span of 150 feet, weighs 15 tons, and has tires 7 ft. 6 in. high. It is so large that it can only enter a hangar sideways on small trucks.

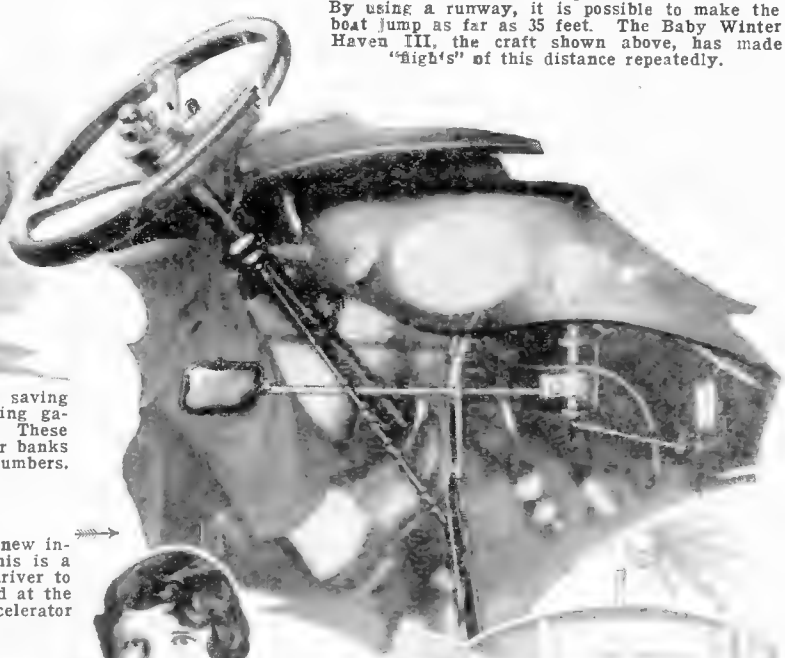
Progress

of Modern Scientific Advances

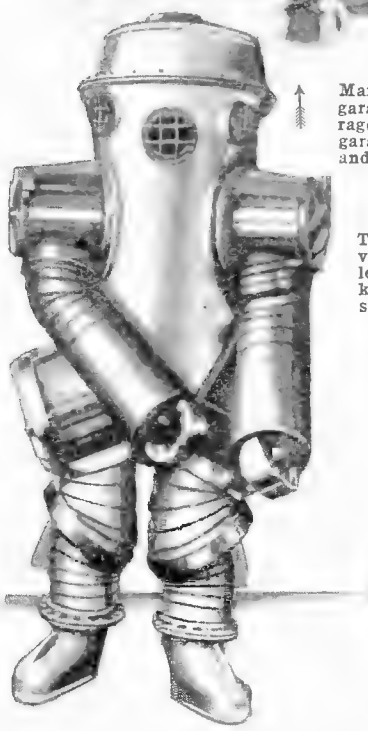
On these pages we can portray but a few of the advances made in many different fields.

Above we see how the flying boat shown on the opposite page actually leaped out of the water. By using a runway, it is possible to make the boat jump as far as 35 feet. The Baby Winter Haven III, the craft shown above, has made "high's" of this distance repeatedly.

Many car owners in Sweden are saving garage rent by employing floating garages such as that shown above. These garages are now dotting the river banks and are growing to increasing numbers.



The photo at the left shows a new invention for safer driving. This is a leg accelerator, enabling the driver to keep his foot on the brake and at the same time manipulate the accelerator with his leg.



A new diving suit, enabling the occupant to work for at least 45 minutes at a depth of 200 feet, has recently been invented by H. L. Bowdoin and is shown above. The suit is made entirely of metal and has a steel body with overlapping units of aluminum at the joints. The total weight is 1,400 lbs.

A device combining a talking machine and a visual chart which run in synchronism is shown above. Instructions are written as well as vocalized by the "portable tutor," an invention of A. L. Runyon.

At the right is a photo of the altitude chamber which has been developed by the U. S. Bureau of Standards for restoring the hearing to the deaf.

The above photo shows a summer ice-rink made of artificial ice in Berlin, Germany. This is the first one of its kind, and is produced chemically, as shown at the left, where workmen are spraying the artificial surface over the rink.

The Strangest

Utilizing the Law of Averages Is One of the Modern

By UTHAI

YOU may be different from all other human beings in the wide world. You may, but the chances are, that you are not. Your habits and even your methods of thought will be quite similar, say to that of Bill your neighbor across the street, or Timpken, the fellow next door who is always wanting to borrow something.

The fact of the matter is that human beings, when you average them up, are surprisingly alike. And human impulses are fairly constant. When equipped with a knowledge of all items entering into a situation, you yourself could forecast precisely how a man would react under any given set of circumstances.

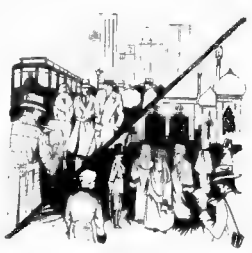
Business has learned this truth and utilizes it in a profitable way. Individuals are learning to use it for their pleasure as well as their profit. Perhaps the chief reason that insurance companies are so wealthy is because they accurately judge the future course of events. They know that under certain conditions—age, climate, occupation—just how many men and women will be seriously ill during the year. They also know the number that will have disastrous fires, and the number who will be struck down on the streets. They know that out of all the buildings insured a certain definite number will be struck by lightning.

THOSE HAVING NUMBER NINE SHOES

YET there is nothing uncanny about their figures. They have successfully interpreted the law of averages.

If you are going into the millinery business you would be told by manufacturers that you should place in stock but a small percentage of women's hats that are large and a great number that are small. If you sell ready-made clothing, you will be told to secure a definite percentage of stout sizes. If you are going to sell shoes and doubt the advice given you by the manufacturers you might play a little game by way of testing this law of averages.

Stop five hundred people on the street and ask them the size of their shoes. Then go to another city or take up your location on another street and ask five hundred more. Your answer is in the back of the book. It will check up with the advice of the shoe manufacturers and the two streets will give you practically the same results. All because, by the law of averages, each five hundred will include the same percentage of people wearing number nine shoes.



To get a working understanding of the law of averages for your own purposes, for your own home, you begin by keeping records. It is certain that the accurate knowledge possessed by life insurance companies is all a matter of accurate records. It may be that Lloyd's will take a risk as to the weather on a certain day when a championship fight or a football game is to be held out of doors. The promoter is obliged to choose a holiday in order to attract the largest crowd. Next he goes to his insurance broker and takes out a policy covering his loss should it rain. The insurance company in turn asks the United States Weather Bureau for data covering some fifty years of records as to the state of the weather, say, on the first of November. On the basis of the records, the insurance company is bound to win in the long run. It is protected by the law of averages.

SPEAKING OF THE WEATHER

AND speaking of the weather. What is apparently more fickle? "Every time you plan an outing it rains!" you say? Perhaps it is because your law of averages is unconsciously operating in connection with the days which you choose. However, it is far more likely that the records of the Weather Bureau can tell you what your chances are for a clear, pleasant day and the law of averages will be right.

The Weather Bureau of every city in the United States is being constantly used in order to help business. Recently a great company making electric fans sent to all its agents throughout the United States elaborate charts which were based on forty years' records. Using this information the dealers were told just when to advertise fans—even to the day of the week and the month. They were advised when to buy stock and how many days of the year fans could be easily sold in their particular city. This was all based on weather conditions—humidity, rainfall, heat, and so on.

Newspaper publishers are showing an uncanny understanding of the law of averages as compared with the weather. They have learned, for instance, that a newsboy will sell one hundred and forty-nine papers on a clear Sunday morning; when, however, the weather promises to be disagreeable and cloudy they will print more, for the same boy will sell two hundred and eleven. Thus the weather report means more than a mere announcement each day.

There are the department stores. They have a sale planned which must attract a certain number of people in order to dispose of a certain quantity of goods. "But what about the weather?" asks the manager of the advertising director. The Weather Bureau will be consulted and past store records while the particular advertisement stands ready to be run on last minute orders.

Then, strange as it may seem, it is not a hard rainy day that worries the management so much as a stormy or threatening morning. In fact, according to the law of averages, Mrs. Jones will sally forth on a fair morning to buy through the lure of the newspaper bait. Should she, however, encounter a shower along about noon, by this same law of averages, the store management knows that she will decide to stay in town, eat her lunch, and because she has nothing else to do she will buy more merchandise. If the day had continued clear, she would have hurried home to her mending or visiting.

WEATHER THAT MEANS PROFIT

IN St. Louis, Missouri, there is a well known hardware firm that is constantly making practical use of the law of averages. For example, each day they take the little stacks of sales slips that come in by mail from the men on the road and weigh them. Thus they know, without further study, the average amount of money the sales represent. Each ounce of the little slips means so many dollars. One slip may be for a bill of goods amounting to the thousands, and the next may cover a quarter's worth of nails. A computation of the slips have proved the accuracy of their experience. The results vary but a few cents.

Another concern asks their men to send in information and daily reports on the weather, temperature, rainfall, and so on—as well as information regarding crops. They even arrange to get such information from England.

DO you know—that the "law of averages" may spell all the difference between success and failure, in any business you may undertake? The author of the present article tells you how the law can be applied to your business or profession. Retail stores are located by mathematics today—not by guess.

It is true that a rainy March and April in any section of the United States means that there will be a large demand for scythes and sickles and lawn mowers in June. Under the law of averages a specific number of men out of each thousand will buy lawnmowers, but the number who buy new ones depends upon how luxuriant the grass grows. A dry Spring and sales on garden hose thus have a definite relation.

In the Treasury Department at Washington there is a man who plays with the law of averages and obtains answers to questions which affect the whole United States.

This man is Joseph S. McCoy, who is listed merely as an actuary, yet, although not in the public eye he takes a set of figures and another group of numbers and puts them together according to the law of averages and so finds out what you and your neighbors will do as regards income taxes, tariff and many other things.

When the Underwood Tariff Bill was being drawn, McCoy was called upon to tell as to the way that people would pay the various amounts.

It was McCoy who estimated with accuracy how much money would thus be secured and whether a certain item could be made to bear a ten per cent or a thirty per cent tax.

HE COUNTED THE POPULATION NINE YEARS BEFORE

TAXES were not all. Congressmen also wanted to know what the population of

# of All Laws

Methods of Success in Crowded Fields of Business

V. WILCOX

THE simple arithmetical "law of averages" enabled an expert to foretell to within one per cent, the population of the United States, nine years before it was actually counted! You can apply this simple law to your business ventures or projects and determine the chances of success beforehand.

the United States would be in 1910. They asked in 1901. And when the Census Bureau had counted them it was found that McCoy using the law of averages nine years previously came within one per cent of the count!

The way that McCoy did these things was apparently simple. He would take a pad of paper and standing on the street corner count the number of pedestrians and the number of automobiles and compare these with the population of the city and by taking in the variable factors producing prosperity he was able to estimate accurately the number of automobiles in the United States.

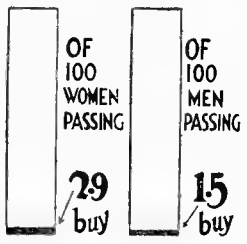
Congress asked McCoy regarding the number of men who belonged to clubs when a tax on clubs was being considered. He was also asked regarding the people who go to the movies. His answer to these was simple. He asked every man that he met as to how many clubs he belonged, if any, and he asked his wife how often she went to a movie and he asked her to ask her friends. Thus by counting on human nature in Washington he was able by using the law of averages to know about what the women in Kansas and California would do. His estimate as to those who daily go to the movies was twelve million. Some of the motion picture producers at first disputed his figures but when they checked up by their own records they admitted that he had obtained an accurate estimate. Yet McCoy found out by casual conversation plus the law of averages!

For example, a great chain of ten cent stores or drug stores are not set haphazardly about cities. Far from it. First come those who count the number of people who go by the corner and whether they are men or women. In this way it was discovered that a room on one side of the street might be a loss while on the opposite side the same merchandise would sell easily. In fact, the cost of the storeroom is generally adjusted according to the number and class of people which passed its doors.

The ten cent stores and the chain drug stores can tell from year to year what their losses will be as judged by the weather. A high wind will mean so much, and rain will mean so much more.

There was Holt who wanted to run a candy store but his capital would not permit him to pick his location aimlessly. He went into the shopping district of his city and found a locality where the women pedestrians were more numerous than the men. He counted the traffic and found the average number of persons passing each day, 15,557—9307 women and 6250 men.

He had learned from previous investigation that the grade of candy he expected to sell would attract to his store two and nine-tenths women out of every hundred passing, and one and five-tenths men. Therefore he might expect each day 269.9 women buyers and 93.75 men, or a total of 353 persons in his store.



Holt proceeded to choose a vacant store 1500 feet from any other candy shop. That distance from competition would mean an average purchase of about 35 cents. Multiply the number of persons expected to enter his store by 35 cents and he had the average expected daily receipts—$123.55. On such a basis, allowing 300 business days to the year, the annual gross income should be $37,065.00.

It was such factors as these that made his business a success for in actual operation Holt kept well within his figures which he had thus used as a basis to guide him. Incidentally he knew better than the owner of the rented room the value of the location and thus was not compelled to guess.

WOMEN MORE CARELESS!

ACCORDING to the law of averages, women are more careless in guarding their property in public than men, but in shouldering responsibility for negligence men are the most reasonable. So say the statistics!

A superintendent of the lost article department of a street railway company of Washington, who has handled thousands of articles of varying value during sixteen years of service, has compiled such records.

The lost article department is interesting in itself as showing with what degree carelessness will operate. The walls of the rooms are marked off with spaces for sixty days and a glance will show just the sort of weather experienced here on these days. Let the day be rainy and the particular section is packed with umbrellas, the next day there will be fewer and on a clear day none at all. Women's umbrellas greatly predominate.

Next come women's gloves, and because most women cannot tell where they left their gloves more of these are uncalled for than umbrellas. Third, there are found various articles of clothing. Yet, of all the articles left, the newly purchased ones seldom are picked up because people are more careful of the new than of the old. As on street cars so with automobiles. Insurance companies show that the older the automobile the more likely it is to be stolen. The new car is almost certain to be locked and watched but the older one promotes disregard.

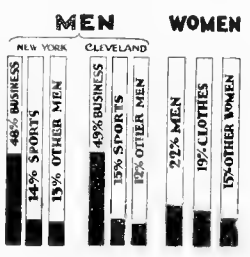
WHAT PEOPLE TALK ABOUT

THE chief topics of conversation for men and women certainly forecast dominating interests. Many lines of business have prospered consciously and unconsciously through a correct utilization of these trends.

While it is not always the case that people talk only about that which is to them of uppermost interest, it may rightly be assumed that the majority of people are considerably interested in the topic which they choose for beginning the conversation. Given the results for classes of people, the law of averages gives valuable trends.

It is this law of averages that has taken much of the guess work and the element of chance from business. Some phases of the law are increasingly valuable as the years pass by. A study of the law in its relation to home affairs and tastes is always stimulating.

Recently two psychologists of the Ohio State University tabulated some five hundred conversations with a view to learning the chief interests of men and women, particularly those who live in cities. The conversations tabulated were of people in restaurants, at games, in theater lobbies, in front of store windows, in barber shops, at church doors, in clubs, and on the streets. These conversations were tabulated under ten headings, business and money, women, clothes and decoration, sports and other amusements, study, health, self, and weather. New York and Columbus, Ohio, were the cities chosen.



The results showed that East or West the favorite topic of conversation for men was business. Talk in which business was the chief topic scored 49 per cent in Columbus and 48 per cent in New York. Sports and amusements came second, with a frequency of 15 per cent in Columbus and 14 per cent in New York. The third topic of conversation that stood out in a preeminent degree for men was talk about other men—12 per cent in Columbus and 13 per cent in New York.

The chief interest of men might well be summed up in a fragment frequently noted: "There wasn't a bank in town that would lend us a nickel in those days. . . ." There followed the story of some personal success against odds real or apparent.

With women the results could be visualized by another fragment: "And when I wouldn't give him a date he . . ." For with women, the leading and favorite topic was found to be men, followed closely by clothes. For men, 22 per cent, and for clothes, 19 per cent. The third topic was other women at about 15 per cent.

After a tabulation of these, the percentage of conversational topics as between men and women and between women and men was noted. The favorite for a woman with a man was something about amusements. That is, she most frequently talked about the motion picture that she had seen or the play that she wanted to see or some sporting event. Secondly, she talked frankly about clothes and thirdly about herself and other men.

SUBJECTS TO TALK ABOUT

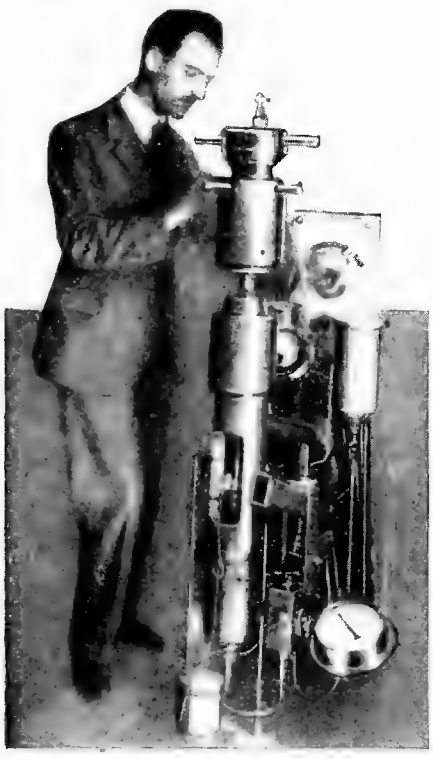
THE men, perhaps recognizing women's interest in amusements, conversed about these in the majority of instances when they talked with feminine companions. Secondly they reverted to their apparently chief in-

(*Continued on page* 268)

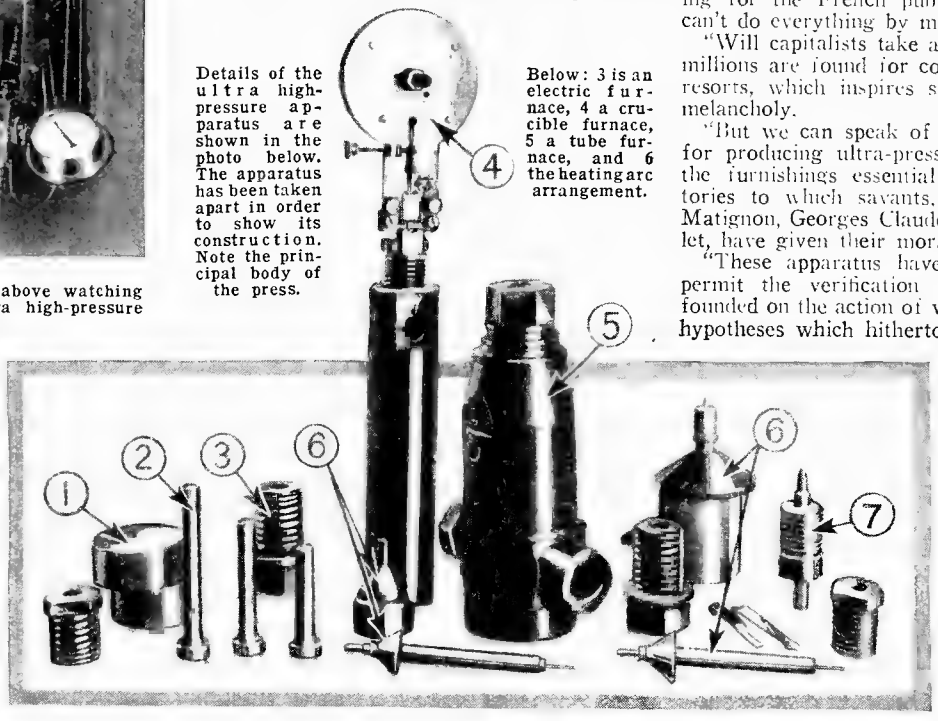
Synthetic Diamonds

French Genius Explains How His

By LUCIEN
Paris Correspondent of



Mr. James Basset is shown above watching an experiment with his ultra high-pressure apparatus.



Details of the ultra high-pressure apparatus are shown in the photo below. The apparatus has been taken apart in order to show its construction. Note the principal body of the press.

Below: 3 is an electric furnace, 4 a crucible furnace, 5 a tube furnace, and 6 the heating arc arrangement.

IT can be well acknowledged that after the experiments of Moissant the synthesis of the diamond has made no progress and without disputing the scientific value of the work of the illustrious savant, we may ask if, using the compression of solidified cast iron, the fragments of graphite placed in the mass during its fusion, pressure and temperature being assumed to be sufficient for the success of the operation, the crystals obtained were not those of pure crystallized carbon.

It seemed evident if not absolutely demonstrated, that the synthesis of the diamond would only be effected by the combined action of these two forces. Now it is possible actually to reach in a practical way temperatures of three thousand degrees, but no apparatus has as yet succeeded in producing a pressure above two thousand five hundred kilograms per square centimeter (35,200 lbs. per sq. in) during the time sufficient for and under the conditions permitting a systematic experimentation.

There also is lacking the means of producing a sustained pressure of about 40,000 lbs. per square inch, which caused a young French savant, M. James Basset, to carry out researches in this domain. A recent communication to the Academy of Sciences informs us that he has solved the problem by means of an apparatus which enables him to obtain, in a chamber with steel walls, pressures of twenty thousand kilograms per square centimeter (284,000 lbs. per square inch) and to maintain them as long as an experiment can require and utilizing at the same time enormously high temperatures.

We have paid a visit to the inventor who did not tell us how he conducted the experiments for the synthesis of the diamond, but gladly spoke of his ultra-pressure apparatus, and explained to us what industrial and scientific consequences ultra-pressures could bring about. Mr. Basset reminded us of the interesting work at very high pressures carried out by another savant, M. Bridgman, in another scientific domain. "Why do we want to speak of the synthesis of the diamond?" he said to us. "It is not brought to success; my researches are well on their way, but it would be premature on my part to publish anything whatever on this subject."

And the conversation took another course. Here the inventor, changing the subject, spoke to us of the torpedo invented by Esnault Pelterie for transversing interplanetary distances. "A curious conception to be realized, but with very limited possible application," Mr. Basset maintains, "because assuming that the torpedo could leave the earth, and complete the desired voyage, we would never know what happened, because if the impossibility of having a traveler go with it to be always lost along with his projectile.

"I have found something better," he added. "It is a projectile which would slowly rise from the earth by its own force, would take up a progressive increasing rate of speed, acted on by the terrestrial magnetic field up to the limit of this field between the earth and the moon, and would continue its voyage until it reached our satellite, driven for the rest of the way by the magnetic field thereof.

"After having reached the surface of the moon, he could get back to earth by its own forces. This is possible in the actual state of science."

But as if he wanted to make me forget at once the question of the synthetic diamond, he spoke of his theory of matter, of the speed of light; he showed that the vacuum is only a senseless idea, a word absolutely and really a "vacuous" one.

Then the savant put a question to me: "Do you believe that the speed of light is always a constant? Are not Einstein and our modern physicists in error?"

I heard without answering—for the thought of the artificial diamond inspired me with patience.

With this devil of a man you get further and further from that which you would like to know.

"Synthesis of the diamond? Yes, perhaps. Am I near it, or am I far from it? I myself do not know.

"I have built all my apparatus hitherto at my own expense, and to carry out under the necessary conditions my work, I would require three ultra pressure apparatus with an assistant in charge of each. I am waiting for the French public to help me. I can't do everything by myself.

"Will capitalists take a hand? In France millions are found for constructing pleasure resorts, which inspires scientists with deep melancholy.

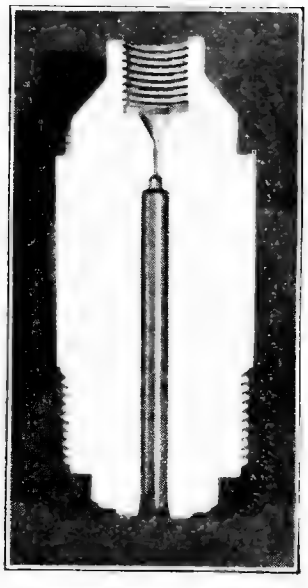
"But we can speak of apparatus invented for producing ultra-pressure which will be the furnishings essential to future laboratories to which savants, such as MM. C. Matignon, Georges Claude, A. Blondel, Guillet, have given their moral support.

"These apparatus have been invented to permit the verification of the hypotheses founded on the action of very high pressures, hypotheses which hitherto have been impossible to control.

ULTRA-PRESSURES AND SCIENCE

"Ultra-pressures," M. Basset told us, "double the extent of physical methods placed at our command for acting directly on the molecular structure of bodies, imposing on their physical properties great modifications, changing their appearance totally, and their physical and chemical characteristics.

"It is easy to realize the great importance represented by ultra pressures for the greater part of natural sciences, and particularly for



Above is a view of a high-pressure press which has burst apart at 30,800 pounds pressure. The walls are 1¾ inches thick.

Now Possible

Ultra High-Pressure Apparatus Works

FOURNIER
Science and Invention

physics and chemistry, the rational, complete and at last possible exploration of this new domain. We find, in fact, physical conditions of pressure and temperature realized now, which it has been hitherto impossible to obtain, and which nature alone could operate with in the depths of the earth.

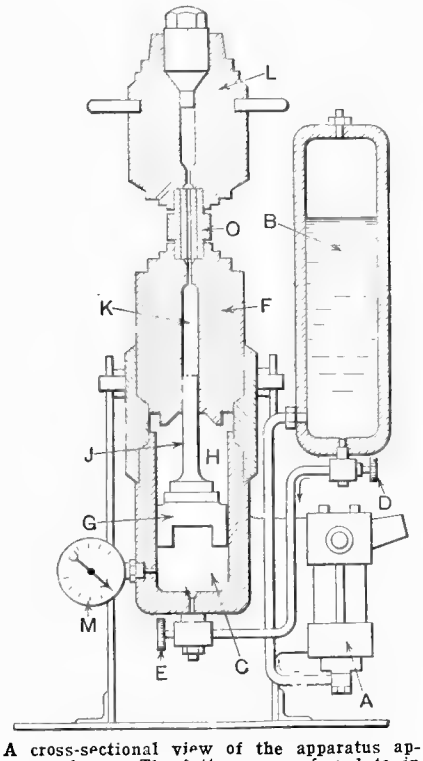
"Under the influence of ultra-pressure, the chemical affinities are modified to a great extent. The chemistry of gas which has been so developed by ordinary high pressures can now give further results in quantity by applying ultra-pressures.

"Mineralogy has in ultra-pressures an unhoped for power for realizing in the laboratory innumerable syntheses under exact experimental conditions, and to bring about thus all the natural crystallizations in which pressure plays an important rôle. Our own researches are only a small part of what has to be studied in the different applications of ultra-pressures.

"In physics the study of the general properties of bodies acted on by ultra-pressure, presents an interest of the first order, enabling us to push to an extreme degree the verification of all sorts of laws developed at ordinary pressure. This will certainly bring about the discovery of the many anomalies of properties. The influence of pressure determines, for example, the curious periodic functions of the physical state, which will enlighten our knowledge anew, which will permit us to get to the depths of the constitution of matter, and when we do know it, will perhaps enable us some day to utilize the prodigious power which appertains to it.

"Natural science has to study the action of ultra-pressure on the vegetable and animal cell, and the work could be pushed on to the study of the entrancing enigma of life.

"Medicine and micro-biology themselves find in ultra-pressure a new factor for modifying the properties of the substances which they employ, treatment at ultra-pressures being able to completely transform the action. The use of this new process constitutes a specialty in the new method of sterilization in the cold, perhaps to present a considerable interest in some lines."



A cross-sectional view of the apparatus appears above. The letters are referred to in the text.

HOW THE APPARATUS IS CONSTRUCTED

THE general principle is easy to understand from the diagrams which accompany the text illustrating the way ultra-pressure is obtained.

Above are the pistons of the primary compression press and the ultra pressure press.

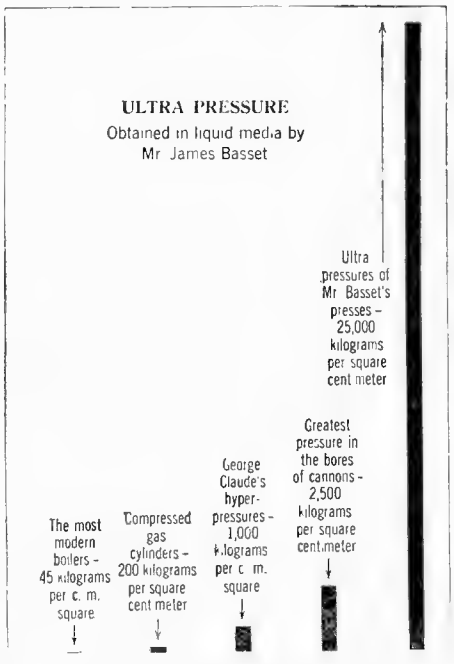
The pump, A, compresses to one thousand kilograms per square centimeter (14,220 lbs. per square inch) in an auxiliary reservoir, B, forming an accumulator, a liquid to supply the primary press cylinder, C, by special valves with pointed plugs, D and E. The pressure gauge, M, gives the pressure in the primary press cylinder, C.

The generator of high pressures comprises a principal press, F, mounted in perfect center over the press, C.

The piston, G, of the press, C, carries a base end, H, on which a secondary piston, J, rests, made of extremely hard steel, which centers itself in the body, K, of the principal press, F.

This last is composed of a succession of cores of increasing diameters of special steel which has been subjected to a series of mechanical and heat treatments, enabling it to resist the enormous strains which the apparatus has to endure.

The end of the piston, J, is terminated by a special joint, securing absolute tightness, and permitting the piston to be displaced in the core, K. The perfection of the sliding joints is such that the pressures employed can be maintained for several days without its being necessary to touch the apparatus for compensating losses which are absolutely nil.


ULTRA PRESSURE
Obtained in liquid media by
Mr James Basset
Ultra pressures of Mr Basset's presses – 25,000 kilograms per square cent meter
Greatest pressure in the bores of cannons – 2,500 kilograms per square cent.meter
George Claude's hyper-pressures – 1,000 kilograms per c. m. square
Compressed gas cylinders – 200 kilograms per square cent meter
The most modern boilers – 45 kilograms per c. m. square

The above graph shows the comparative values of normal and ultra pressures. An apparatus similar to that shown in the photos gives pressures of 213,000 pounds per square inch. 1 kilogram is 2.2 lbs., and 1 sq. in. equals 6.45 sq. cm.

The relation of the squares of the diameters of the pistons, J and G, gives the ratios of the pressures in the chambers, K and C.

What we show refers to an apparatus for working with liquid media; for working with gas, special arrangements are used for introducing in the chamber, K, the gas compressed to a higher degree of pressure in an apparatus analogous to that which we have described, so as to produce two stages of ultra-pressure.

The experiment-chamber, L, is mounted on top of the apparatus, and is especially arranged for receiving crucibles for chemical reaction, electric furnaces, or any particular arrangements required for these experiments. The two chambers, K and L, are connected by a tubulure, O, formed by special concentric tubes.

The hole through which communication is maintained is only seven-tenths of a millimeter in diameter (about 1/32 inch), while the exterior diameter of the tube is thirty-two millimeters (1¼ inches).

An apparatus similar to that which our photographs represent gives permanent pressures of fifteen thousand kilograms per square centimeter (213,000 lbs. per square inch) but in the principal press it can reach twenty-five thousand kilograms per square centimeter (352,000 lbs. per square inch).

One of our photographs shows the body of one of the first presses that was built, and which burst at fourteen thousand kilograms (30,800 lbs.), the limit of the resistance of the metal exceeded two hundred and fifty kilograms per square centimeter (3,550 lbs. per square inch); the thickness of the walls was forty-five millimeters (1¾ inches). This represents, for the section which burst, a strain of four thousand tons, for an apparatus where the pump cylinder was only of twelve millimeters (15/32 inch) internal diameter.

We reproduce, with the permission of the inventor, views of some cross section diagrams of a crucible furnace for experiments with ultra-pressures. They are enclosed in steel tubes from which they are insulated electrically, and calorifically.

It will be seen that the researches concerning

(*Continued on page* 260)

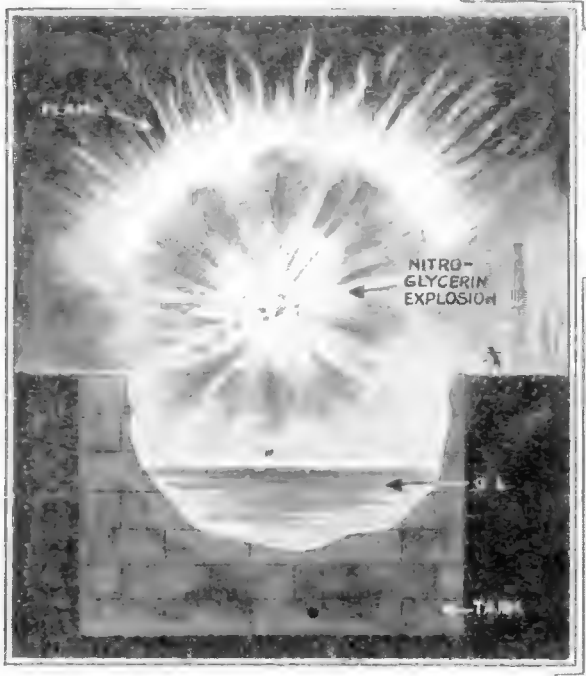
The Month's Scientific News Illustrated

By GEORGE WALL

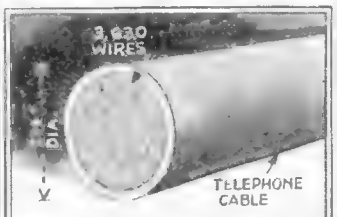
Passengers flying from London to Paris may now witness motion picture programs en route. A small projector is mounted in the plane and it receives its current from a generator driven by the customary air propeller located on the wing. Such motion picture apparatus could give instructions to passengers for strapping parachutes on their person and the proper methods of leaving a plane in emergency.

In October this year, the International Air Traffic Exposition at Cologne will disclose a new German device for shooting pilots from airplane cockpits. The pilot's seat, with a parachute attached, is placed on a compressed air chamber, the power from which will hurl a man 20 or 30 feet when a lever is pulled.

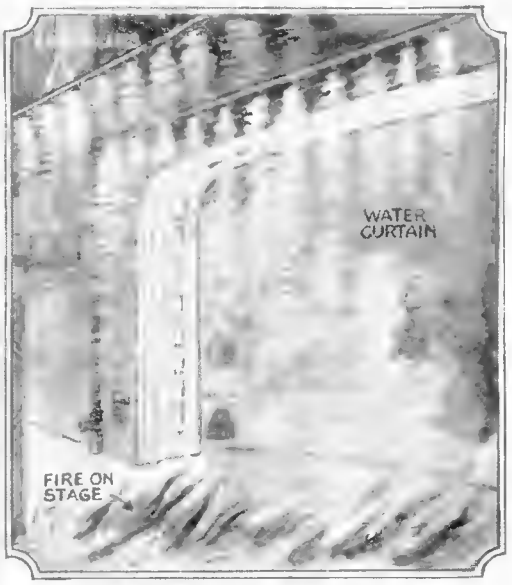
The Paris police force classifies noises as agreeable, almost harmonious, tolerable and intolerable. Instead of using the ears to judge the degrees and qualities in harmony in the noise of automobiles, they use a camera which transforms the sound vibrations into a wavy record of light on a moving film. The record settles court disputes.



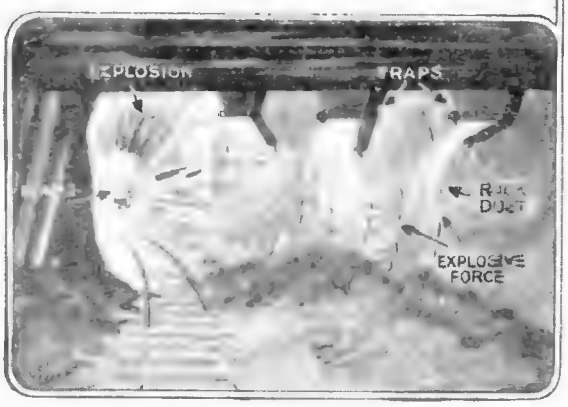
Fighting oil-well fires with nitro-glycerine is the work done by "Tex" Thornton who, single-handed, has blown out more than 300 oil-well fires in the last five years. The fire fighter uses 30 quarts or more of nitro-glycerine which is placed in a shell between the top of the casing and the flame. The flame begins from 15 to 20 feet from the mouth of a well. If successful, the fire is blown out.



The largest phone cable in the world is to be put into use at Springfield, Mass. This will be capable of serving 7,272 subscribers on four-party lines. This cable is 50 per cent larger than those previously used.



Two of Stockholm's best known playhouses, the Svenska Teatern and the Oestermalms Teatern, having recently been demolished by fires, caused the authorities to spur action for making the remaining theatres fireproof. Part of this fireproofing is accomplished by installing water curtains. Sprinklers are placed clear across the stage and extend from immediately behind the proscenium arch to the back wall.

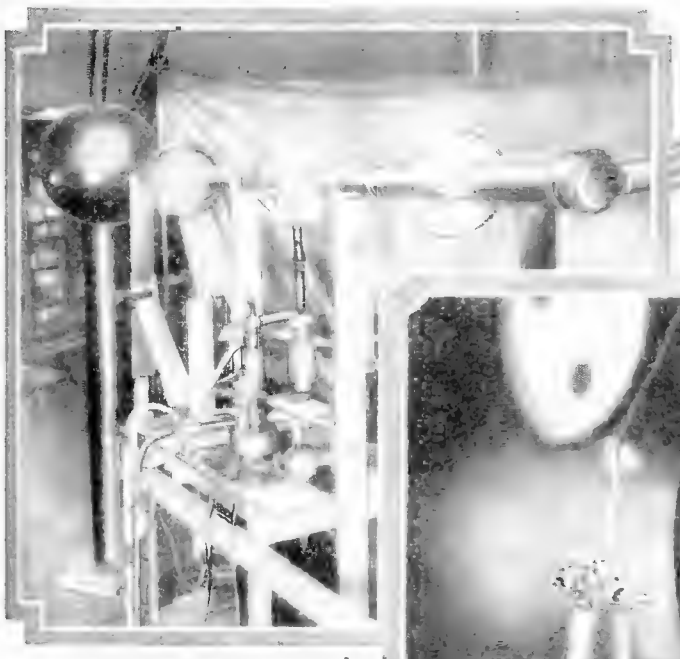


Many fruit growers frequently meet with a difficulty which has been solved by Dr. T. B. Bass, of Abilene, Texas. His fruit trees bloomed and then a late frost would come along and kill all possibility of a crop of fruit. So the doctor set about fooling his fruit trees. He was going to take no chances with a late frost. Hundred pound cakes of ice were packed around the base of the tree. This ice was then covered with straw to prevent too rapid loss. Thus the fruit trees do not know that spring is here.

The use of rock dust as a preventive for mine disasters was demonstrated by the U. S. Bureau of Mines a short time ago. In an experimental pit, 400 feet back from the mouth, 800 pounds of fine coal dust was distributed and ignited by a blow-out shot of black blasting powder. Rock dust suspended on traps is released by the explosive force traveling a split second in advance of the flame, spreads a choking cloud on the flame. Water is futile in a mine fire, the fire must be suffocated.

Super-Power Cathode Ray Tube

Below is a photograph of a three-section high-voltage cathode ray tube.



The new Coolidge tube which is shown above, is a sort of three-in-one arrangement of the first tube, developed by Dr. Coolidge, which operated at 300,000 volts. The tube is 95 in. long and has 3 bulbs each 12 in. in diameter. The glass tube is shielded with a copper tube, so that the electrons cannot strike the glass and cause punctures. The electrons expelled from the tube travel about 350,000 times faster than a shot from an army rifle.

The discharge from the tube appears as a purplish haze, as the electrons are shot forth at the rate of 175,000 miles per second.

The Coolidge 900,000 volt cathode ray tube is shown above. Chester Moore, left, and L. E. Dempster, assistant to Dr. W. D. Coolidge, are shown getting the tube ready for operation, in the General Electric Research Laboratory.

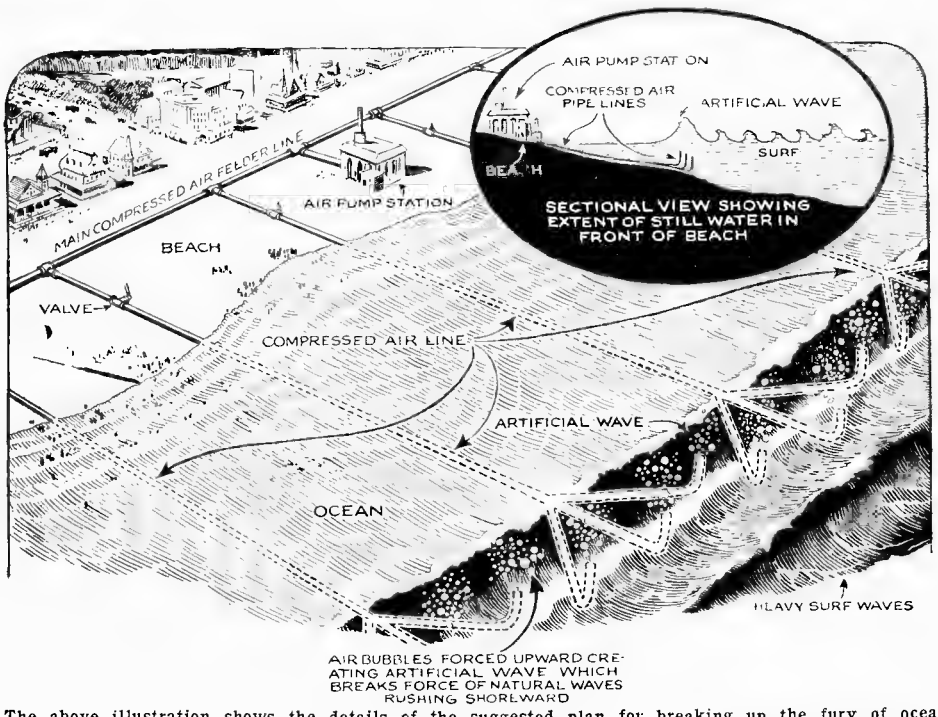
A SUPER-POWER cathode ray tube operating at 900,000 volts, has recently been developed by Dr. W. D. Coolidge, in the laboratories of the General Electric Co., at Schenectady, New York. The tube is built according to the multi-sectional system, and the window from which the electrons are emitted is of thin metal foil about one 10,000th of an inch in thickness. A heated tungsten filament furnishes the supply of electrons. The development of this tube offers an alluring view of many scientific possibilities. Further knowledge of radiation laws, of the atomic nucleus and application in therapeutics will probably develop. The 900,000 volt tube will produce as many electrons in a second as a ton of radium. It is expected that a high voltage positive ray tube can be constructed along the general lines of the multi-sectional cathode ray tube.

A Folding Speed Boat

Above is a view of the new folding racing boat as it looks when packed up. The boat can travel at 30 miles per hour and is fitted with an eight horsepower outboard engine. It weighs, in all, 160 pounds and can be folded up and put away in a small space. It has been appropriately named, "The Stowaway."

Above we see the folding racing boat speeding up the Thames River, at Putney, England. Some idea of its relative size can be obtained from the photograph. The outboard engine which is placed in the back of the boat is shown in the photograph at the left. The boat is an English invention of exceptionally novel design and construction.

Science Calms Ocean Waves



The above illustration shows the details of the suggested plan for breaking up the fury of ocean storms. Artificial waves are created by compressed air blasts. The insert shows a sectional view of the beach.

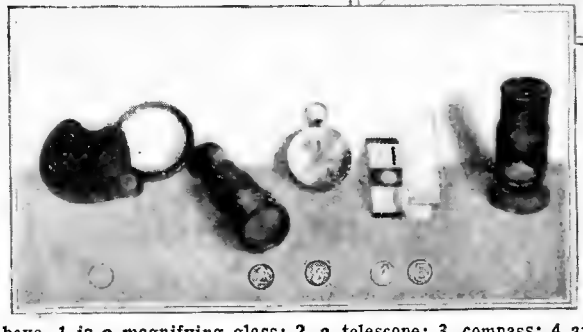
A PLAN whereby the inroads of the sea during storms would be checked by high-pressure air blasts, is now being considered by the New Jersey Board of Commerce and Navigation. In Asbury Park and vicinity much damage is done each year by the tremendous surf. The scheme consists of running several pipes out into the ocean about 1,200 feet, and forcing compressed air through them. The air, which rises up to the surface at the seaward end of the pipe, would form an artificial wave or wall of water, which would break up the incoming waves. Valves located at intervals in each branch of the compressed air line would be used to control the air. Phillip Brasher, of Princeton University, has conceived this plan for controlling the fury of the ocean storms.

RAZOR-BLADE SCISSOR

Details of unusual French scissors made from razor blades are shown above.

OPTICAL KIT

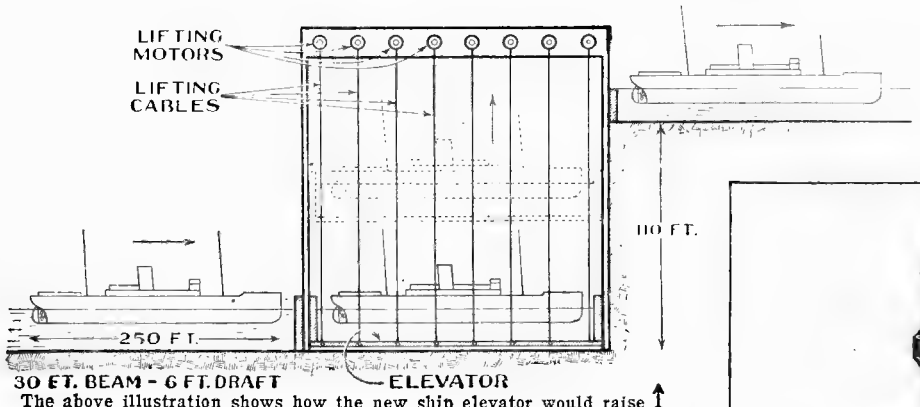
AN optical kit, containing a pocket magnifying glass, telescope, compass, prepared slides, blank slides, and a powerful microscope, has recently been brought out by a Rochester manufacturer. The various instruments included in this kit may be seen in the photo at the right.—*Name of manufacturer supplied upon request.* ⟶



Above we see the microscope in use. At the left is a photograph showing the various instruments.

Above—1 is a magnifying glass; 2, a telescope; 3, compass; 4 and 5, slides, and 6, the microscope.

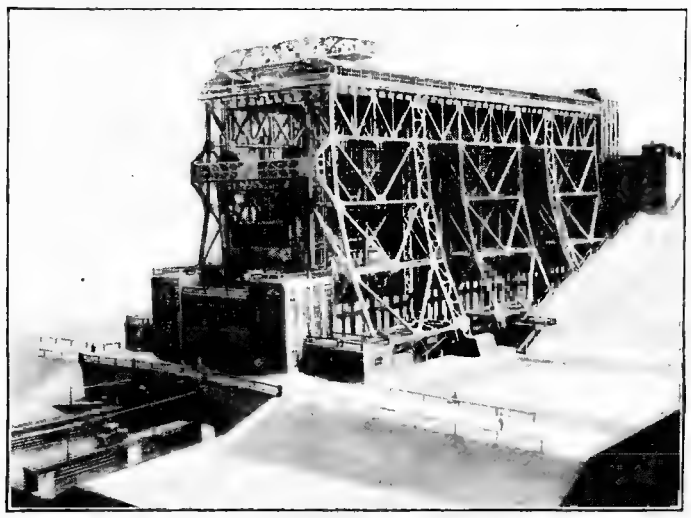
New "Ship Elevator" Largest in World



The above illustration shows how the new ship elevator would raise a boat 110 feet.

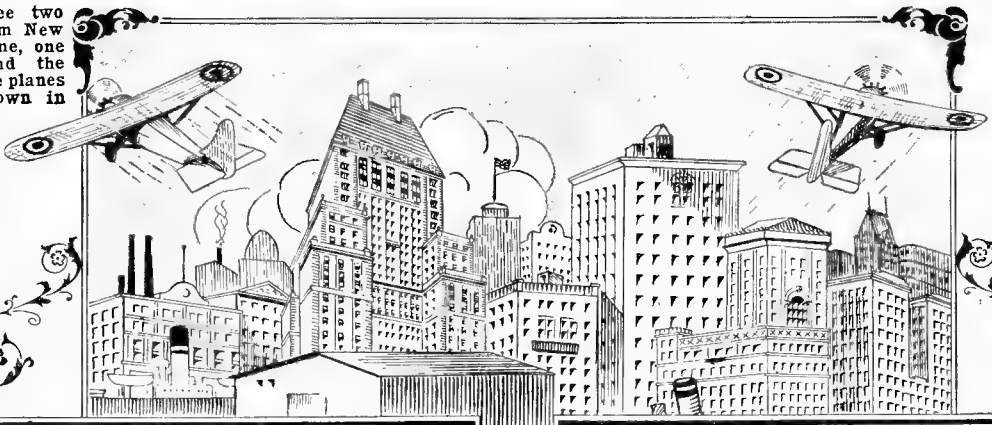
The photograph at the right shows a view of the model of a proposed ship elevator. The elevator will be capable of lifting ships 250 feet long. ⟶

A NEW ship elevator has recently been proposed in Berlin, Germany. This huge structure will raise boats 110 feet from the lower level to the top, taking ships 250 feet long, 6 feet draft, and with a beam of 30 feet, yielding up to 1,000 tons displacement. It is claimed that this immense structure can be completed in a few years. The photo reproduced here shows a view of the model made by the inventor. The drawing illustrates just how the lifting is accomplished. A large elevator is connected to a number of lifting motors, by heavy cables. The ship is allowed to float into the elevator, which contains water, the lifting motors are started and the tank is pulled to the top, carrying up the floating ship. An elevator of this sort can be used for putting ships in drydocks or in canals, thus doing away with the canal locks, which are necessary at the present time.

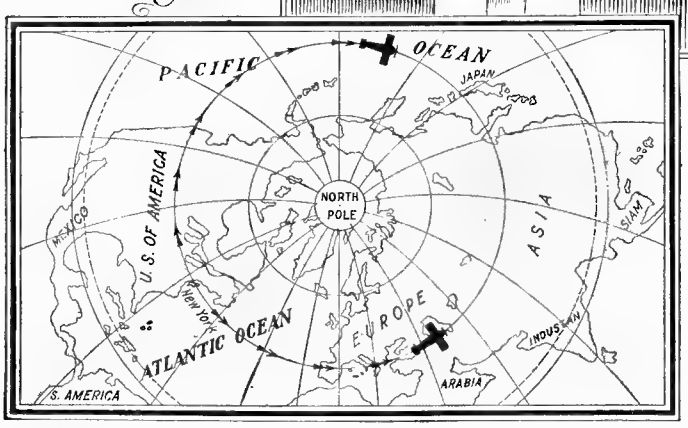


Where Will These Planes Meet?

At the right we see two airplanes leaving from New York at the same time, one flying due east and the other flying west. The planes follow the route shown in the illustration below. According to the German magazine, "Reclams Universum," these planes will meet in the Gobi Desert, in Central Asia.

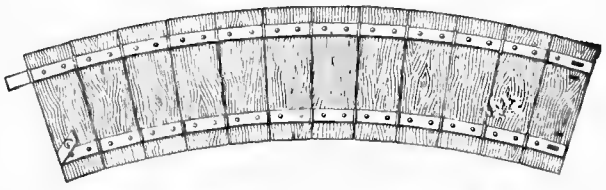


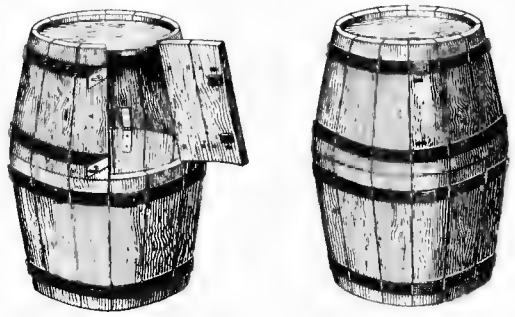
The two airplanes which left New York simultaneously meet in the Gobi Desert, as shown below. The Gobi has the form of a great plateau whose surface, lying 3,000 feet or more above the sea, is divided into dreary wastes of sand, rocky table lands and mountains. The climate is severe, especially on the borders. It is here that the two planes, flying at the same rate of speed, will arrive at the same time.



TWO airplanes leave New York at the same time, flying at the same rate of speed, one winging its way due east and the other west. These planes follow the course shown in the map appearing above. Where will these planes meet? Strange as it may seem, they will arrive at the same time over the Gobi Desert. This great waste is situated in central Asia and lies 3,000 feet above the sea. This dreary section of the country is inhabited by Mongolian, Tartar, and other similar races of people.

A Novel Folding Barrel



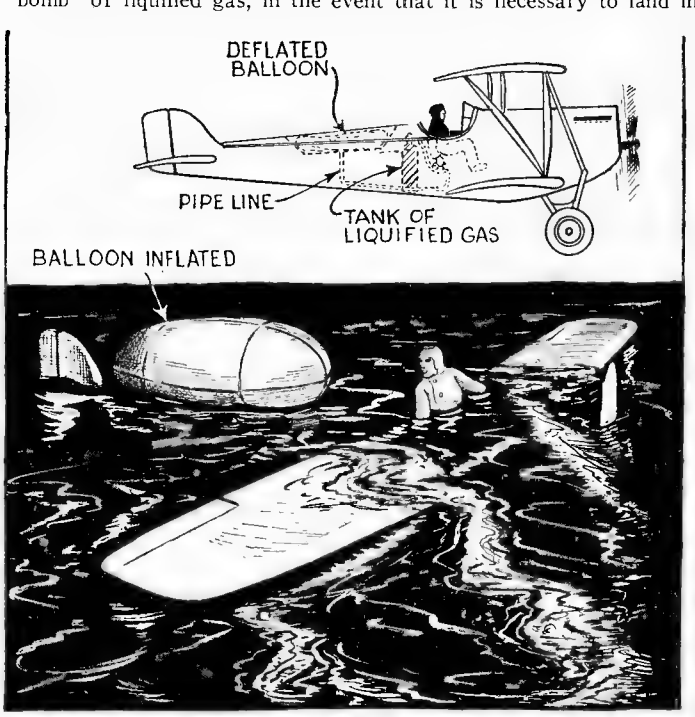


The details of the unique folding barrel are shown in the illustration above. Each stave is hinged to the adjoining one by means of a flat strap hinge.

THE folding barrel shown above is the invention of Mr. Ralph Aversa and is unusual in many respects. It can be used for the shipment of perishable vegetables and the like, and may be folded up into a small space when not in use. The secret lies in the fact that it is built in two sections, which are held together with hinges. The staves themselves are also hinged together. The barrel can be completely assembled or taken apart in a few minutes' time and when folded up, occupies very little space. The inventor claims that the new barrel will gradually replace the crates and usual types of barrels now used in shipping market commodities. Another advantage of the barrel is the fact that it can be filled and unpacked easily and more quickly than the old style barrel.

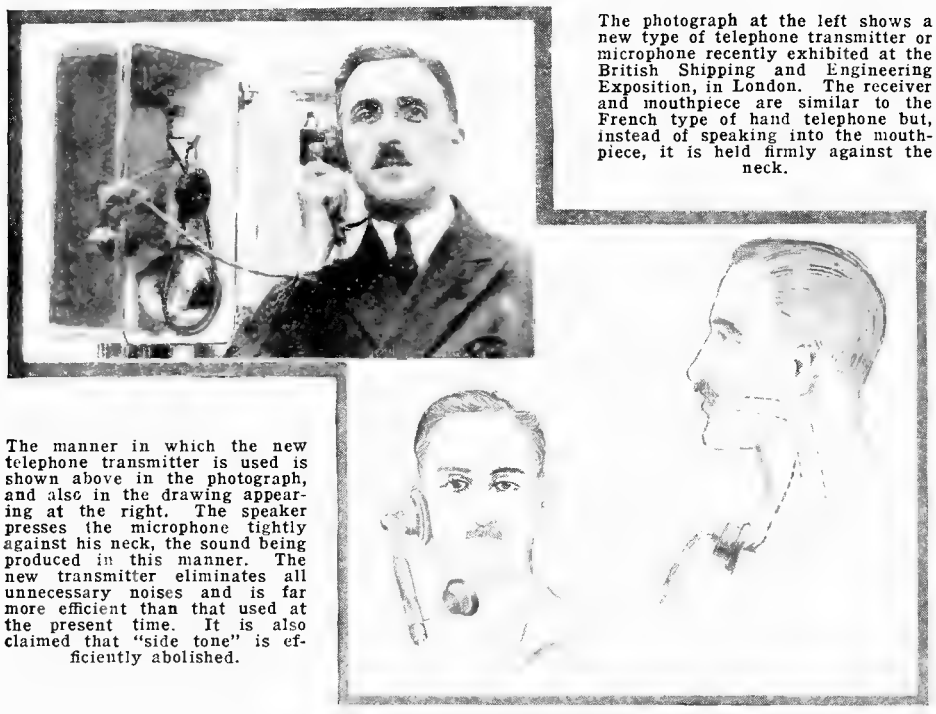
New Airplane Safety Device

THE U. S. Navy has developed a new device as a means for saving the lives of airmen forced down on open water. Attached to the top of the fuselage, behind the pilot's seat, is a deflated balloon which can be quickly inflated by releasing a "bomb" of liquified gas, in the event that it is necessary to land in the water. This balloon will float the plane for a considerable length of time. In the illustration shown here the deflated balloon is connected to a tank of liquified gas with a pipe line. The pilot pulls a lever and the gas is allowed to flow from the tank into the balloon. It is expected that this new safety first device will save the lives of many airmen forced down on open water.



At the left we have an illustration showing the new safety device installed on an airplane.

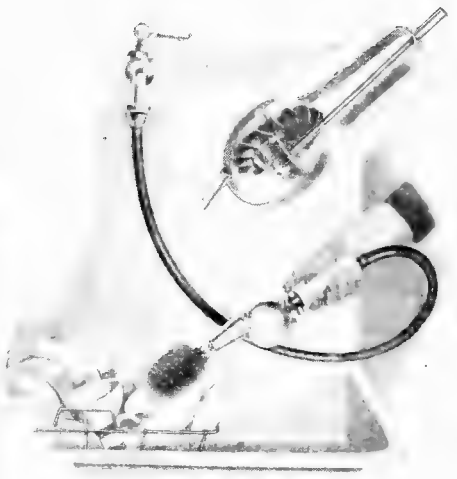
New Telephone Transmitter



The photograph at the left shows a new type of telephone transmitter or microphone recently exhibited at the British Shipping and Engineering Exposition, in London. The receiver and mouthpiece are similar to the French type of hand telephone but, instead of speaking into the mouthpiece, it is held firmly against the neck.

The manner in which the new telephone transmitter is used is shown above in the photograph, and also in the drawing appearing at the right. The speaker presses the microphone tightly against his neck, the sound being produced in this manner. The new transmitter eliminates all unnecessary noises and is far more efficient than that used at the present time. It is also claimed that "side tone" is efficiently abolished.

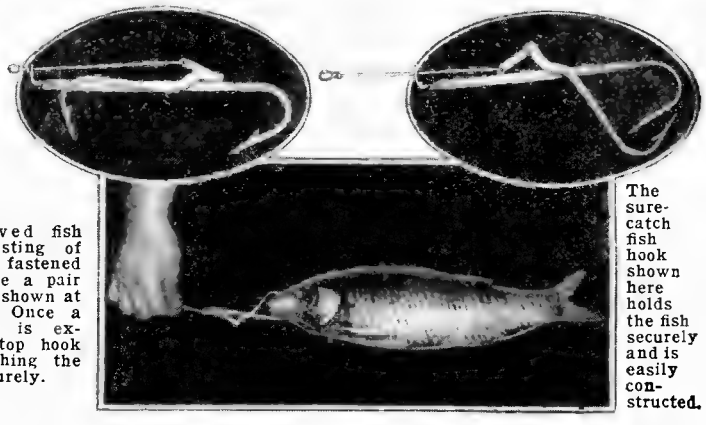
Dish Washing Aid



A new help for the housewife has recently been put on the market in the form of a dish washer. The device is fitted with a water motor which rotates the brush, at the same time water is forced out the end. It comes complete with a handy grip and a long length of rubber tubing fitted with a metal end for attaching to the faucet.—*Name of manufacturer supplied upon request.*

Sure-Catch Fish Hook

An improved fish hook is shown here. It consists of two hooks fastened together like a pair of pliers, and when in a normal position one of them is held away from the bait hook. Once a slight pull is given the lower hook by the fish, the other instantly drops and holds the fish securely. The stronger the fish pulls, the more tightly he is held. The device is an invention of M. L. Stevenson. —*Geo. Solkover.*

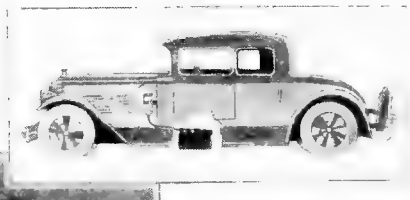


An improved fish hook, consisting of two hooks fastened together like a pair of pliers, is shown at the right. Once a slight pull is exerted, the top hook drops, clinching the fish securely.

The sure-catch fish hook shown here holds the fish securely and is easily constructed.

Battery Filler

The battery filler installed is shown at the right.



At the left is a photograph of the automatic battery filler which fills the battery with fresh distilled water, and keeps the level of the water in the cells at exactly the right height. The device fastens to the dash and will fit any car or any make of battery. A durable glass container holds the distilled water.

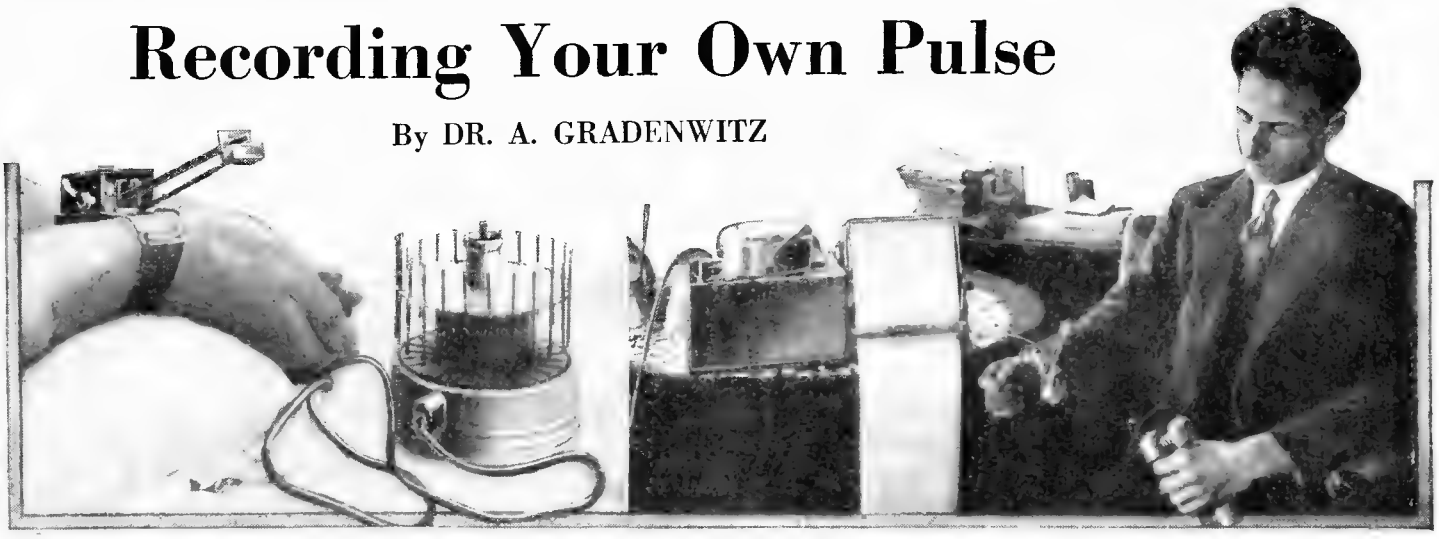
A new automatic battery filler, simple, foolproof and quite moderate in cost, has recently been put on the market by a Pennsylvania manufacturer. The filler will fit any make of car and any battery. The entrance of the distilled water into the battery is controlled by capillary attraction. When the water in the battery cells reaches a level where more water is needed, the capillary attraction arms drop down to the wells of the feed line carrying the water to the battery. When the cells have sufficient water, the supply is automatically cut off. *Name of manufacturer supplied upon request.*

A Strange Electrocution

An actress in the Follie Bergère was electrocuted recently when her dress, which was covered with sequins, came in contact with a live wire, and passed 200 volts through her body.

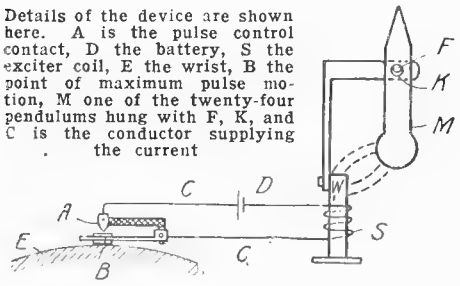
Recording Your Own Pulse

By DR. A. GRADENWITZ



The pulse recorder is shown above attached to the wrist of the patient. The pulse recorder is shown above in operation. Note the paper chart.

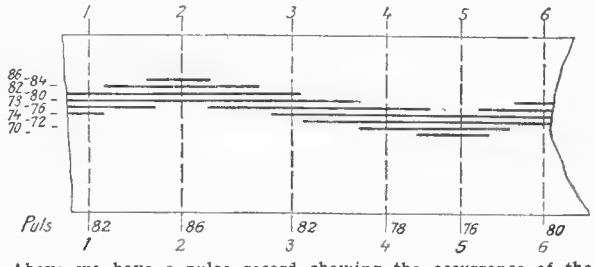
THE idea of recording the rhythm of our heartbeats and pulse is not new in itself, but though much good work has, for instance, been done in connection with electro-cardiograms, these not only require



Details of the device are shown here. A is the pulse control contact, D the battery, S the exciter coil, E the wrist, B the point of maximum pulse motion, M one of the twenty-four pendulums hung with F, K, and C is the conductor supplying the current

a most complicated experimental outfit, taking up a room of its own, but as a rule only allow fluctuations of the pulse during short intervals to be ascertained.

At a recent meeting of the Berlin Medical Society its president, Professor F. Kraus, one of Germany's most celebrated physicians, demonstrated an apparatus invented by Dr. R. Goldschmidt, late Professor of the Darmstadt Engineering College, and which he had been testing on a large scale in the largest hospital of the City of Berlin. What this apparatus achieves is actually marvelous, and the way it does it seems to be even more noteworthy. The *pulse resonator*, in fact, enables the pulse to be watched and its frequency recorded automatically for any length of time without any inconvenience to the patient thus examined. A record thus taken reveals some surprising facts, viz., that the normal pulse by no means keeps at a constant level, but changes 4 to 5 times per minute between two fixed frequencies. The difference between these limits as a rule is 4 to 8 beats, though it may rise to as many as 10 to 15. Only in exceptional cases will this range be reduced to zero, thus giving rise to what is termed a "rigid" pulse, which may be a symptom of great temporary fatigue and exhaustion, though smoking a cigar or a lively conversation will often prove an excellent antidote. The same rigidity is often due to the influence of narcotics or to the effect of exhausting diseases.



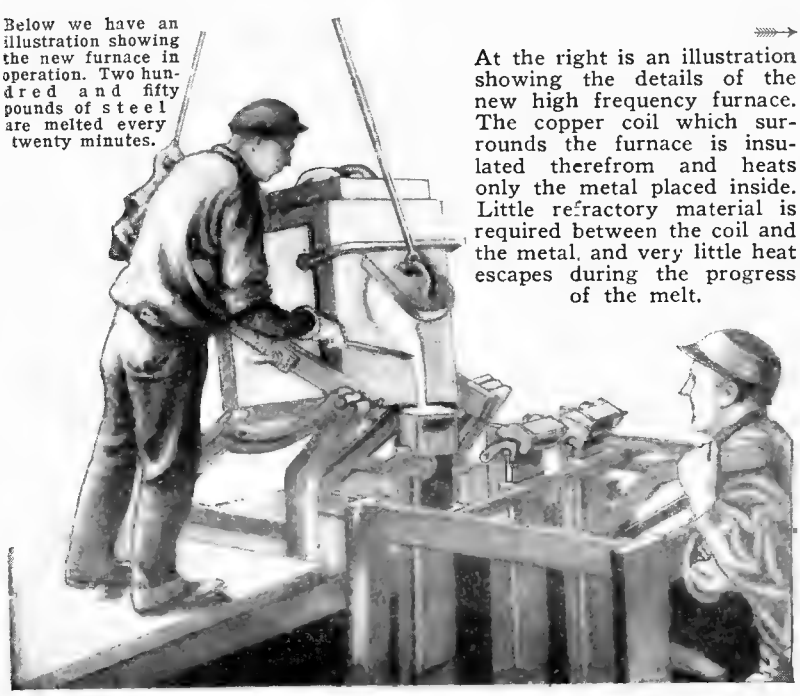
Above we have a pulse record showing the occurrence of the beats and also the number of beats per minute.

The principle of resonance, that is to say, the very principle often used in radio, is the very basis of the new apparatus. The pulse is made to give out mechanical waves, which in turn will strike a series of resonators tuned to all pulse frequencies occurring in

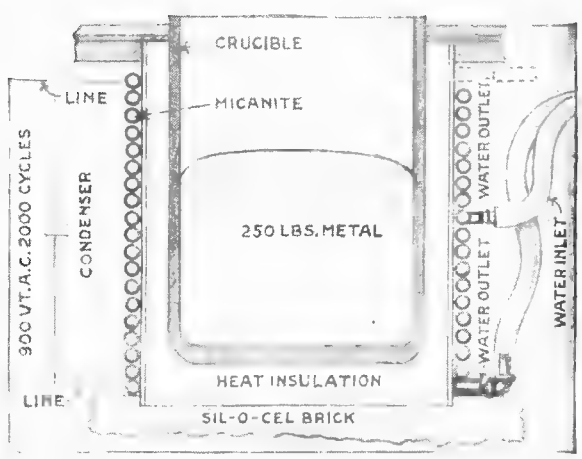
(*Continued on page* 282)

Metal Melts Without Flame

Below we have an illustration showing the new furnace in operation. Two hundred and fifty pounds of steel are melted every twenty minutes.



At the right is an illustration showing the details of the new high frequency furnace. The copper coil which surrounds the furnace is insulated therefrom and heats only the metal placed inside. Little refractory material is required between the coil and the metal, and very little heat escapes during the progress of the melt.



THE high frequency furnace shown here consists of a crucible surrounded by a copper coil which heats the metal placed inside by electrical induction. As the heat is only generated in the contents of the crucible, the metal is said "to melt itself," being vigorously stirred meanwhile by the electrical current flowing through it. Nine hundred volts of alternating current at 2,000 cycles is used, and is derived from a motor-generator rated at 150 KVA. Water flows through the copper coil surrounding the furnace and the temperature of the inductor is thus kept below 50° Centigrade.—*Illustrations courtesy Ajax Electrothermic Corp.*

Automatic Movie Film Developer

Roy Hunter, one of the inventors, watching the newly-invented film developing machine sending out the completed motion picture film, which is wound on reels by the machine.

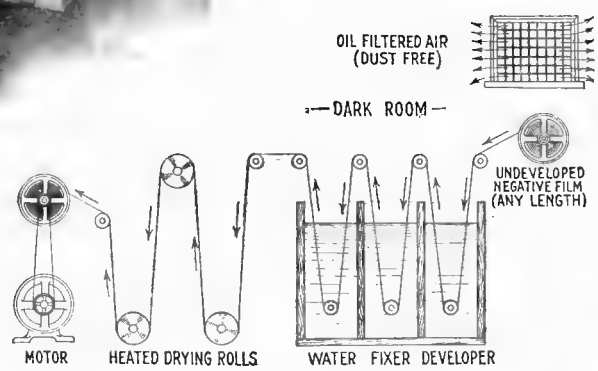
THE tremendous growth of the film industry has caused much highly-specialized machinery to be developed. Among the many large concerns who realize the advantages obtained by maintaining research laboratories, is the Universal Pictures Corporation. As a result of this experimental work a new machine has been perfected which is the latest addition to the list of automatic machines now used by the motion picture industry.

The machine described here, is the result of the work of Roy Hunter and Robert Pierce. These film experts were in charge of the development work carried on in the company's laboratories for several months. This machine has attracted wide attention and it is expected to displace the methods now in use. The operation is entirely automatic. The undeveloped negative is run over chamois pulleys, through a tank containing three compartments holding developer, fixer and water.

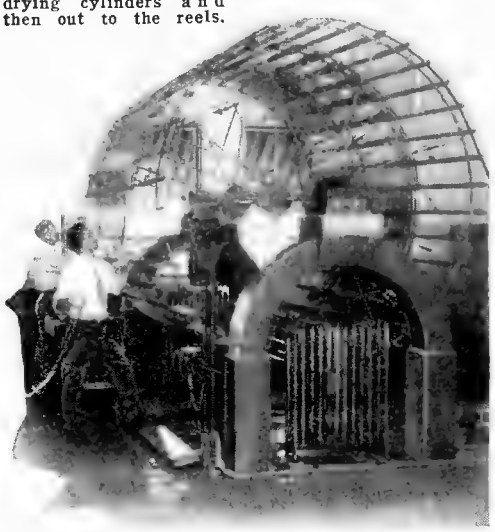
When it has come out of the last bath it is passed over warmed rollers for drying. The air in this room is filtered through oil to remove all dust, and no person is allowed to enter unless wearing dust-proof garments, which are donned in a special adjoining dust-proof room.

The new method makes it possible to develop scenes of any length, since all film is passed through in a continuous ribbon, whereas, formerly, scenes of more than 200 feet had to be broken up for the old developing racks.

Another view of new film developing and fixing machine, which handles entire reels without cutting.



The new method of developing motion picture negatives by machine. The negative starts on the spool at the right and passes through three compartments of the tank containing respectively, developer, fixer and water; then passes onto drying cylinders and then out to the reels.



Obsolete method of drying films.

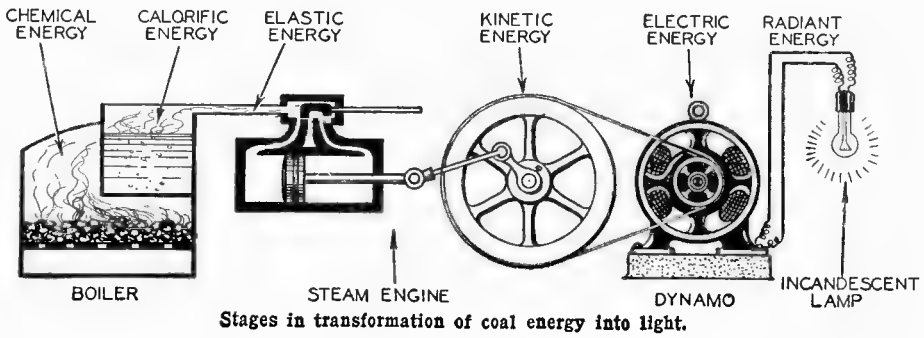
This is the obsolete method of developing motion picture film. Scenes of more than 200 feet must be broken for developing.

From Coal to Light

IT is interesting to follow the chemical energy in coal as it goes through the transformations necessary to produce light from an electric lamp. By chemical energy of coal, we refer to the energy in the form of heat which is generated when the coal is burned. The chemical energy in the coal is transformed seven times before a portion of the energy may be obtained in the form of light. At each of these transformations some of the energy is wasted, with a resulting low over-all efficiency. The ordinary electric power-house which uses coal for fuel wastes about nine-tenths of the chemical energy in the coal, before the energy is transformed into electricity.

If electric power-houses wasted none of the chemical energy in the coal consumed, one pound of coal would run a two and one-half horsepower device for about an hour. Expressing this energy in another way, it would be sufficient to raise a one-ton weight to a height of about one mile providing, of course, that a machine could be made to utilize all the energ without waste.

Every step is accompanied by a loss. The modern incandescent lamp has four times the efficiency of the carbon filament lamp.



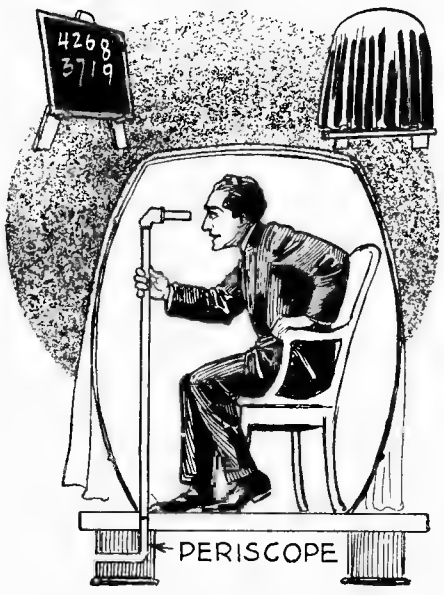
Stages in transformation of coal energy into light.

MAGIC

By "DUNNINGER"

NO. 64 OF A SERIES

THE X-RAY EYE



The magician is seated on a platform covered with a metal barrel, previously examined, and then with a cloth. In spite of this, the wizard reads sets of numbers and totals up columns of figures. The periscope aids him in this work.

THE wizard takes a position on a small platform. A metal barrel carefully examined is then placed over him and the barrel is draped with cloth, to further assure the audience that it is quite impossible for the entertainer to see anything that is taking place about him. A blackboard is then arranged and figures are written upon it by anyone in the audience. Notwithstanding all this preparation, the wizard calls aloud the total of rows of figures that are written on the blackboard, and any or all figures which may be pointed out at random by a freely chosen spectator.

Explanation: This apparent second sight is performed by the aid of a telescopic periscope concealed beforehand in the performer's clothing. He need merely adjust it to a hole in the base of the platform while beneath the cover of the barrel. Anything written on the blackboard is reflected to his eye by the mirrors at the bottom and top of the periscope. Note that a portion of this periscope is a permanent part of the base.

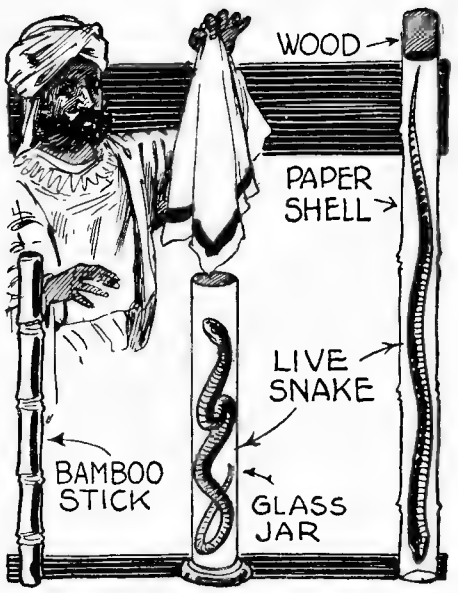
NEW VANISHING HANDKERCHIEF

THE magician takes a small silk handkerchief of brilliant color and fine texture and places it on the tip of his magic wand. Forming his fingers fist fashion, he proceeds to push the handkerchief slowly into his closed hand. As the wand emerges from the opposite end of the hand, it will be found that the handkerchief is no longer over the end, and when the magician slowly opens his hand, the kerchief will have been found to have completely disappeared. Insofar as the effect is concerned, the trick is not entirely new, but the *modus operandi* is distinctive.

Explanation: In this effect, a small weight fitted with a barbless fishhook, slides easily within the wand. When placing the kerchief at the end of the wand, it can quickly be hooked to the weight and, of course, under cover of the hand, the handkerchief is pulled down into the metal wand.

A silk kerchief, having been placed over the end of a wand, disappears apparently within the hand; actually the weight in the metal wand pulls the kerchief down into it.

A HINDU MYSTERY



With the aid of a paper shell made in the form of an imitation bamboo stick, the stick can be apparently converted into a snake; the bamboo disappears under cover of the cloth.

IN the land of the Far East, it has frequently been said that a Hindu can throw his cane on the ground and convert it into a snake. Some writers claim that the snake is paralyzed by holding it just in back of the head and exerting considerable pressure there. However, here is a trick which has also originated in the East. A bamboo stick is tapped against the side of a long glass jar. The stick is then placed in the jar, and the whole covered with a cloth. On removing the cloth, a snake will be found, the bamboo stick having disappeared.

Explanation: This effect is performed by a paper imitation bamboo shell, in which the snake is placed. A wooden plug is mounted in the end so that when the shell taps the glass jar, a genuine ring will be produced. On removing the cloth, the paper shell is crumbled with the cloth, and both are tossed aside. In this way the paper tube can be vanished without in any way exciting suspicion. Of course, the snake glides out of the open end of the tube.

THE ENCHANTED PERFUME VIAL

IN this effect, the conjurer exhibits a small vial of highly-scented fine Oriental perfume. He permits many of those in the room to smell of its contents, and to enjoy its rare fragrance. Placing the stopper in the vial, he puts it carefully aside. Inasmuch as several of the company have been overlooked, someone is sure to remark about it. On uncorking the bottle, this party will find that the fragrant perfume has changed to ammonia or some unpleasant smelling fluid. As the diagram indicates, the vial has a secret cup which holds a small quantity of perfume. When the stopper is placed firmly down in the neck, this vial will be removed with the next attempt to uncork the bottle. For safety, use dilute ammonia.

The Metal EMPEROR

by A. Merritt

Author of "THE MOON POOL", "THE FACE IN THE ABYSS" etc.

(Tenth Installment)

Synopsis

Dr. Louis Thornton is traveling through Tibet with his Chinese servant-cook, Chiu Ming, and two ponies that carried the impedimenta. They come upon a white man who introduces himself as Richard Keene Drake. Drake's father had been very friendly with Thornton. The three decide to carry on and come upon Martin Ventnor, a geologist, and Ruth, his sister. The latter are guarding themselves against hundreds of soldiers who belong to an age at least twenty centuries back. While escaping they are attacked and would have been exterminated, were it not for the timely intervention of Norhala, a tall, beautiful, metallic-haired woman, whose control over lightning and over heavy metallic blocks was phenomenal. These blocks, at her command, would make a bridge for her to walk on or form themselves into battling monsters to protect her or obey her every whim. Chiu Ming is killed in the battle, the survivors leaving with Norhala. Ruth and Norhala get on one of the blocks. The others stand upon a second composed of four smaller ones joined together by their own peculiar super-normal power. The platforms speed through space at a terrific rate, arriving eventually in the court of the Metal Emperor. Angered by the influence of Norhala over Ruth, Ventnor raises his rule and fires at the red ruby-like object he believes to be the brain of the metal monster. He is struck down by a lance of green flame and rendered unconscious. The metal monster gives Norhala the entire company to serve as her toys. She takes them to her home, where she informs Yuruk, her ape like eunuch attendant, they are not to be harmed. Ventnor talks, then lapses into unconsciousness again. Ruth, after telling about the strange power that holds her enslaved, goes to sleep. Drake and Thornton discourse on the metal intelligences, and come to the conclusion that they are guided by some sort of group consciousness, and that they move by super-rapid molecular "steps!" Yuruk, because of jealousy, informs Drake of the way back to the city, which Ventnor, in a semi-conscious state, told them was their only hope. Yuruk claims that though the inhabitants of the city were hostile, it is much safer to escape. Leaving Ruth with Ventnor, Thornton and Drake decided to skip away from Norhala. They informed Ruth that Yuruk has learned the meaning of the pistol. After rather spectacular adventures, they come upon the Metal City, where geometrical and intangible forms are seemingly endowed with super-intelligence. The city saw and was alive. Norhala appears unexpectedly and is just as quickly blotted out from sight. They observe the metal hordes and make the acquaintance of the Metal Emperor, to be subsequently brushed out of his presence, after which they glide away rapidly.

Thornton and Drake finally come upon the birth chamber of the Metal Horde, a surprising sight. The corridor closed and pushed the adventurers off a precipitous cliff. Falling fast, they see Norhala appear. The metal cubes save the two men from destruction. Norhala tells Thornton and Drake that Ruth and Ventnor have been taken captive by Cherkis' men. Norhala causes the Horde to form a mighty metal dragon, which moves forward to Ruszark, the City of Cherkis. Norhala demands the surrender of the maid and the man.

By means of the long metal tentacles at Norhala's command, Ruth and Ventnor are snatched off the ground, after Cherkis had allowed them to appear. Kulun was also licked up by the tentacle, but he was killed a moment later. Norhala has her vengeance and destroys Ruszark and all its people. Later she destroys Cherkis—the scene closes with the dead body of Cherkis being consumed by birds of prey.

CHAPTER XXVII

THE DRUMS OF DESTINY

SLOWLY we withdrew, lingeringly, as though the brooding eyes of Norhala were not yet sated with destruction.

Of human life, of green life, of life of any kind there was none. Man and tree, woman and flower, babe and bud, palace, temple and home—Norhala had stamped them flat. She had crushed them within the rock even as she had promised.

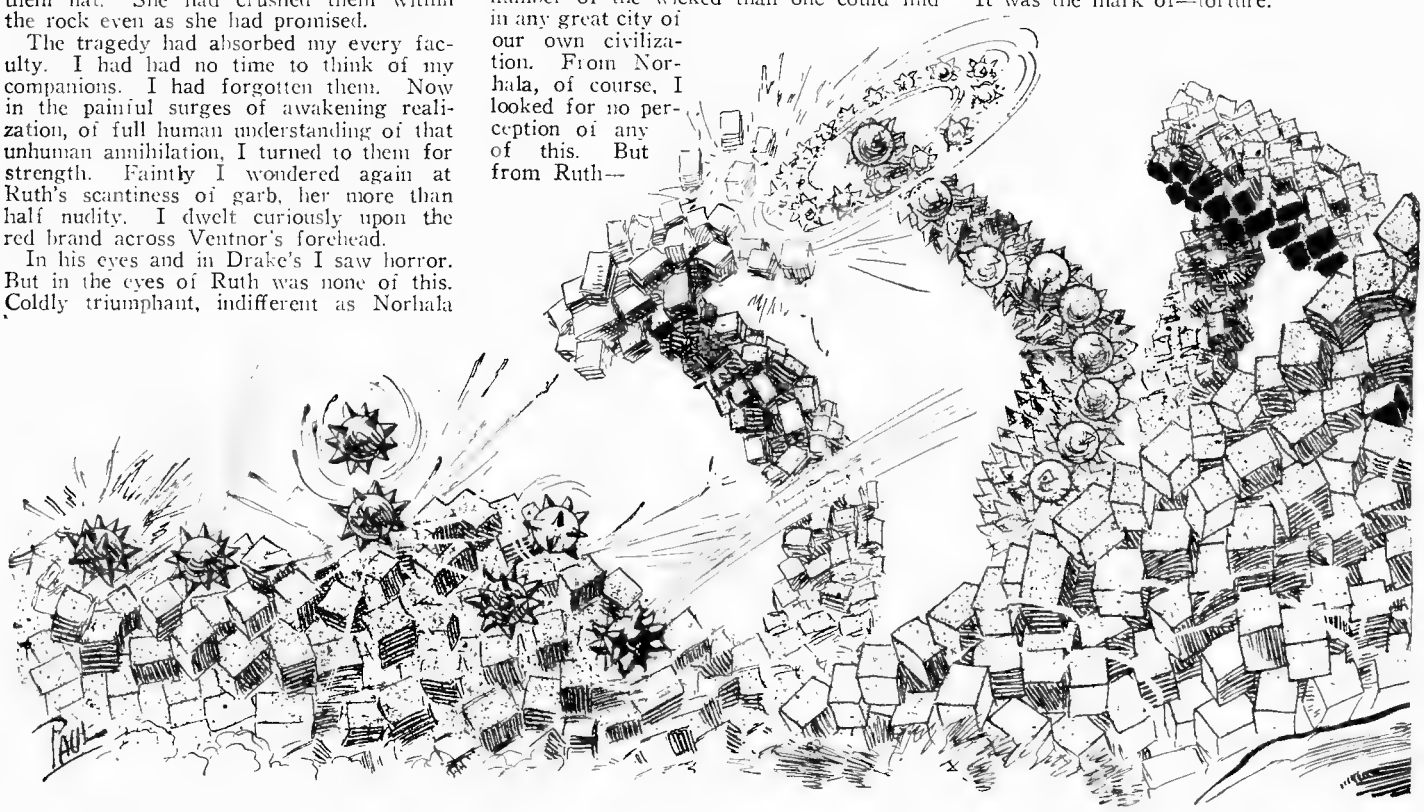
The tragedy had absorbed my every faculty. I had had no time to think of my companions. I had forgotten them. Now in the painful surges of awakening realization, of full human understanding of that unhuman annihilation, I turned to them for strength. Faintly I wondered again at Ruth's scantiness of garb, her more than half nudity. I dwelt curiously upon the red brand across Ventnor's forehead.

In his eyes and in Drake's I saw horror. But in the eyes of Ruth was none of this. Coldly triumphant, indifferent as Norhala herself, she scanned the waste that less than an hour since had been a place of beauty.

I felt a shock of revulsion. After all, those who had been destroyed so ruthlessly could not all have been evil. Yet mother and blossoming maid, youth and oldster, all the pageant of humanity within the great walls were now but stains within the stone. According to their different lights, it came to me, there had been in Ruszark no greater number of the wicked than one could find in any great city of our own civilization. From Norhala, of course, I looked for no perception of any of this. But from Ruth—

My reaction grew. The pity long withheld linked with a burning anger against this woman who had been the directing soul of that catastrophe.

My gaze fell again upon the red brand on Ventnor's forehead. I saw that it was a deep indentation as though a thong had been twisted there, biting to the bone. There was dried blood on the edges, a double ring of swollen white flesh rimming the cincture. It was the mark of—torture.



"Martin!" I cried. "That ring? What did they do to you?"

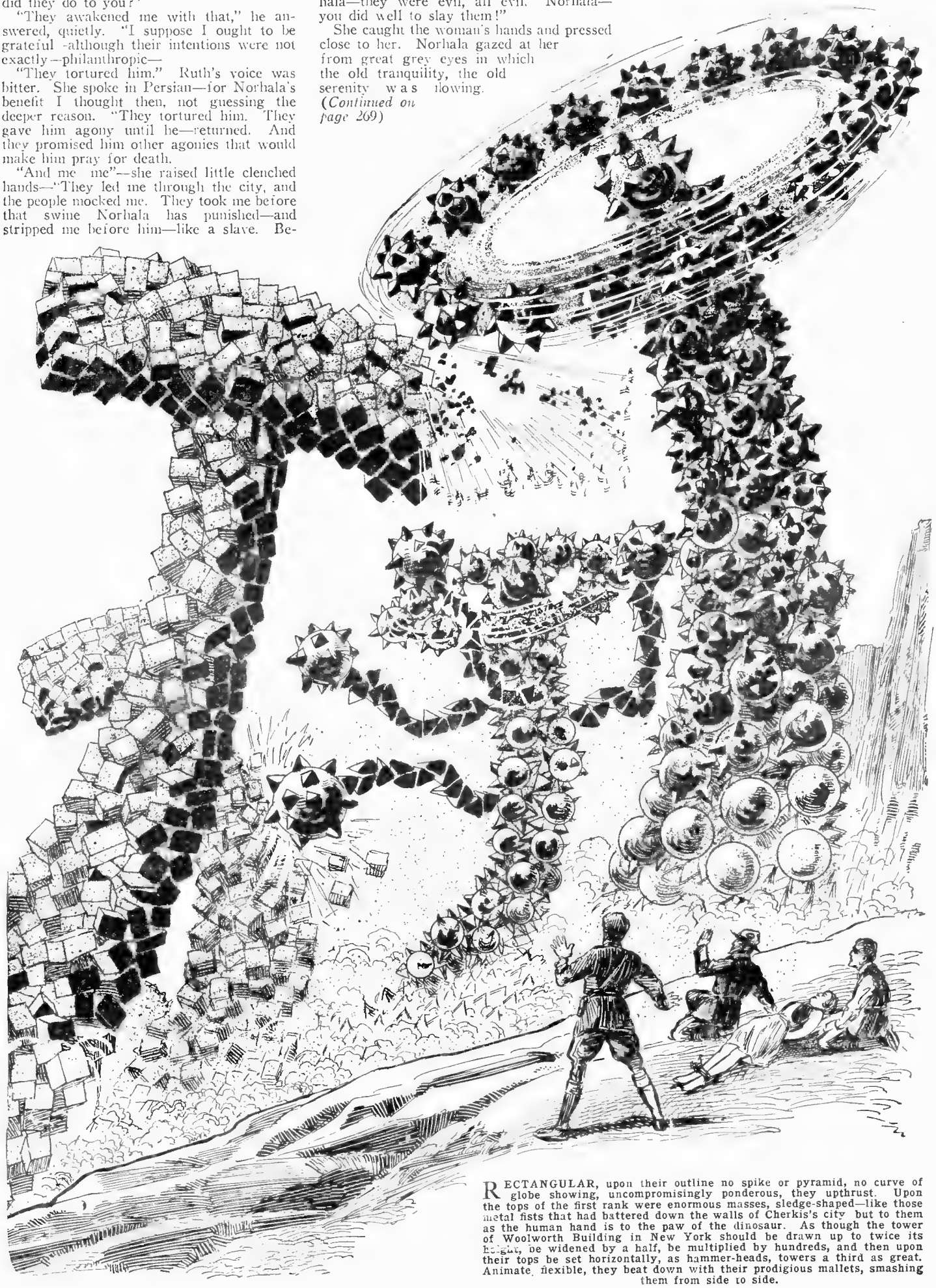
"They awakened me with that," he answered, quietly. "I suppose I ought to be grateful -although their intentions were not exactly—philanthropic—

"They tortured him." Ruth's voice was bitter. She spoke in Persian—for Norhala's benefit I thought then, not guessing the deeper reason. "They tortured him. They gave him agony until he—returned. And they promised him other agonies that would make him pray for death.

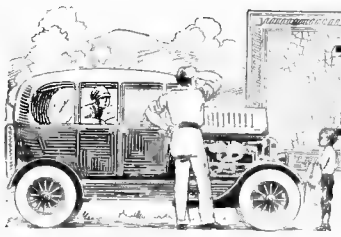
"And me—me"—she raised little clenched hands—"They led me through the city, and the people mocked me. They took me before that swine Norhala has punished—and stripped me before him—like a slave. Before my eyes they tortured my brother. Norhala—they were evil, all evil. Norhala—you did well to slay them!"

She caught the woman's hands and pressed close to her. Norhala gazed at her from great grey eyes in which the old tranquility, the old serenity was flowing.

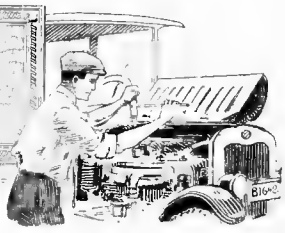
(*Continued on page 269*)



RECTANGULAR, upon their outline no spike or pyramid, no curve of globe showing, uncompromisingly ponderous, they upthrust. Upon the tops of the first rank were enormous masses, sledge-shaped—like those metal fists that had battered down the walls of Cherkis's city but to them as the human hand is to the paw of the dinosaur. As though the tower of Woolworth Building in New York should be drawn up to twice its height, be widened by a half, be multiplied by hundreds, and then upon their tops be set horizontally, as hammer-heads, towers a third as great. Animate, flexible, they beat down with their prodigious mallets, smashing them from side to side.



Motor Hints



Conducted by GEORGE A. LUERS

EMERGENCY PLUG FOR CORE HOLE IN ENGINE CASTING

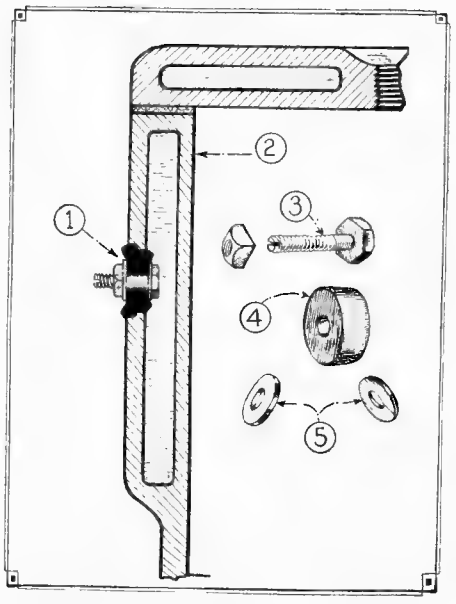
An expedient for patching one of the core holes in an engine, in the absence of an expanding metal plate such as is used for this opening, is shown in the attached sketch.

This means was devised by a motorist, who through reason of an overheated engine lost one of the plates, while on a tour. Through use of it, he was enabled to complete the trip after only a few minutes delay, necessary to make up the fitting.

As is shown, the plug is made up from a circular rubber disc, with two washers and a small bolt to compress the rubber.

In this instance the rubber was obtained from one of the axle bumpers of the car, however, any soft rubber is convertible to this use.

This expedient is worth remembering, inasmuch as the core plates are sometimes pushed out through formation of ice or due to overheating of an engine.



In the above illustration, 1 is an emergency plug for core hole in engine casting; 2 shows section through engine; 3, bolt; 4, rubber disc, and 5, washers.

HOSE FIXTURE FOR CLEANING THE RADIATOR

For avoidance of overheating, nothing quite equals a clean radiator and cooling system.

A means for washing out the radiator, without extra effort or loss of considerable time, can be made following the detachable fixture shown in the attached sketch.

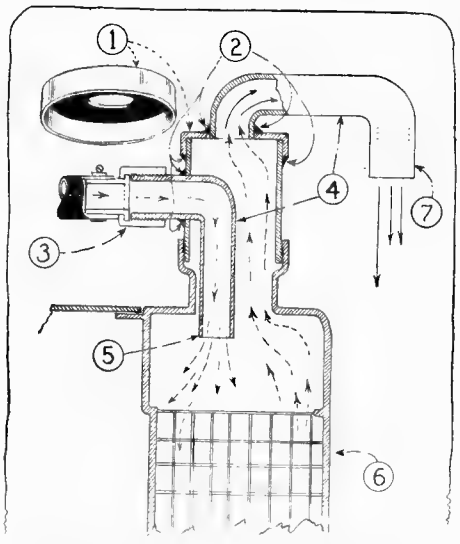
This is a hose connecting device, with an inflow pipe diverting the water through the coils of the radiator and an outflow pipe for the muddy water carrying off the obstructing sediment.

The fixture can be made up of brass or steel tubing, with a connection for the usual wash hose. The inflow pipe is about three quarters of an inch in diameter, and the outflow pipe an inch and a quarter in diameter.

The body is made with threads to fit the radiator spout, the only other detail of importance being a screw connection for the hose.

To use this flusher, the part is screwed into the radiator spout, the hose nozzle is removed and the hose is screwed on and the water is turned on.

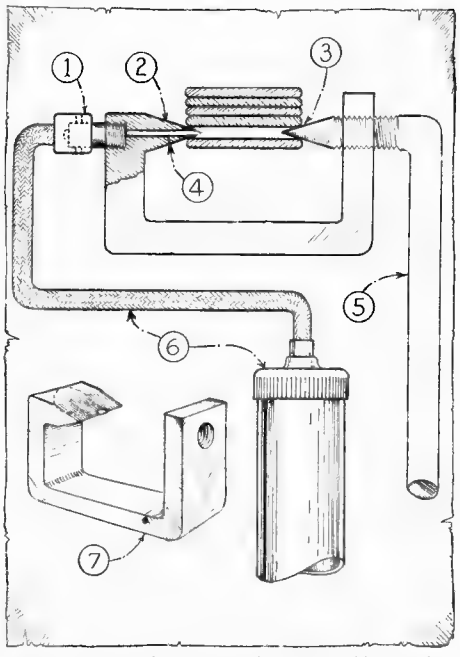
One owner who has used this type of home-made fixture, finds entire freedom from overheating, through occasional use of the flusher to clean out sediment and scale.



Radiator washing device: Above, 1, is a cap; 2 shows connection soldered or brazed; 3, hose connection; 4, brass tubing; 5, inflow pipe; 6, radiator, and 7, outflow pipe.

USE OF GREASE GUN FOR LUBRICATING SPRINGS

The writer recently observed one car owner using a homemade spring greaser, operated in conjunction with a high pressure grease gun for lubricating the springs of his car.



Spring expander and lubricator: Above, 1, grease fitting; 2, spring separator; 3, shows how tool is applied to spring; 4, grease duct; 5, screw to open spring leaves; 6, grease gun and hose, and 7, body of tool.

DO YOU KNOW—

gasoline line connections, which are normally hard to make tight, can be made leakproof with liquid glue, which will dissolve in water but not in gasoline. This is serviceable after overhauling the carburetor or vacuum tank.

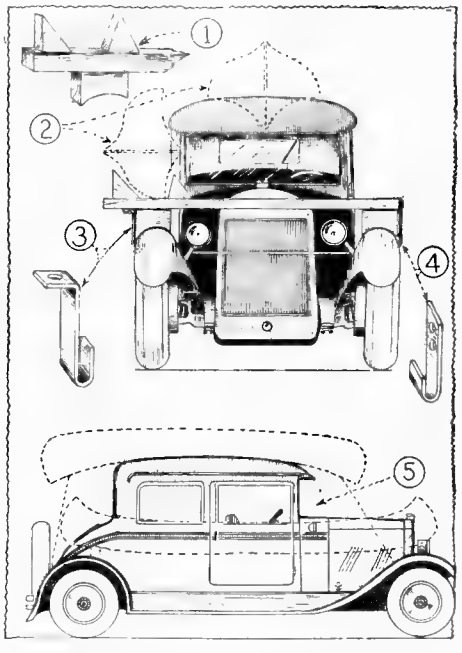
The sketch shows in detail the parts and construction of this useful device, which is worth duplicating.

A simple forged steel body is made up of a piece three-quarter inch thick by two inches wide. This is drilled and tapped for a high pressure grease nipple. A length of cold rolled steel is threaded, pointed and bent, to serve as a spring opener.

With this device the spring is opened without other tools. The gun is attached and a shot of grease is placed directly between the spring leaves.

The tool should be made wide enough to accommodate the spring leaves, with an inch to spare. If the car is replaced by another with heavier springs, the tool can be retained for use with the new car.

BRACKETS TO CARRY A CANOE ON THE CAR



Canoe carrier: 1, shows the details of the bracket; 2, how canoe is carried; 3 and 4, clamps; 5, shows a side view of car with two ways of carrying the canoe. Straps should be used at each end to hold the canoe in position.

The motorist who desires to take his canoe to the lake or river over each week-end, will find the brackets shown in the attached sketch both simple to make up and serviceable in use.

Brackets similar to these have been used by one motorist for two seasons, and the owner has enjoyed the satisfaction of carrying his canoe out on these trips, without damage to the car or the boat.

(*Continued on page* 261)

Auto Theft Prevention

ALWAYS LOCK CAR BEFORE LEAVING

DON'T LEAVE KEYS IN CAR

KEEP RECORD WITH YOU

DON'T LEAVE PARCELS IN PARKED CAR

BE SURE DOORS & WINDOWS ARE LOCKED

THOUSANDS of cars are stolen yearly, so here are a few useful hints to protect your machine from auto thieves.

DON'T fail to lock the car when leaving it, even for a few moments. The majority of cars are taken within ten minutes after the owner leaves them.

DON'T think because your car is insured you can leave your keys in the machine.

DON'T leave your car records in the car. Keep on your person at all times the license number, the serial number of the motor, the serial number of the tires, the serial number of the starter, generator and carburetor, as well as any other identifications marks, such as dents, special color markings, etc.

DON'T leave parcels in a parked car; a thief needs no extra inducement.

DON'T fail to lock all doors and windows if parking.

DON'T neglect the use of secret identification marks on the car, which may be put in by a punch. Even mark the wood.

DON'T use cheap tire locks and chains. These are easily cut.

DON'T park in alleys; here a thief can work freely.

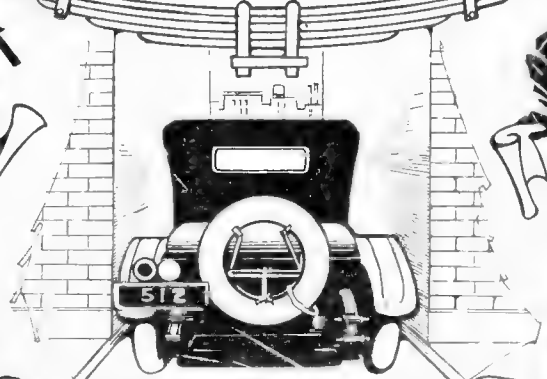
DON'T leave the car out every night.

DON'T neglect to notify the police promptly if it is stolen.

DON'T lose sight of the fact that secret switches may fool the cleverest thief.

PUT SECRET INDENTIFICATION MARKS ON CAR

NOTIFY POLICE WITHOUT DELAY

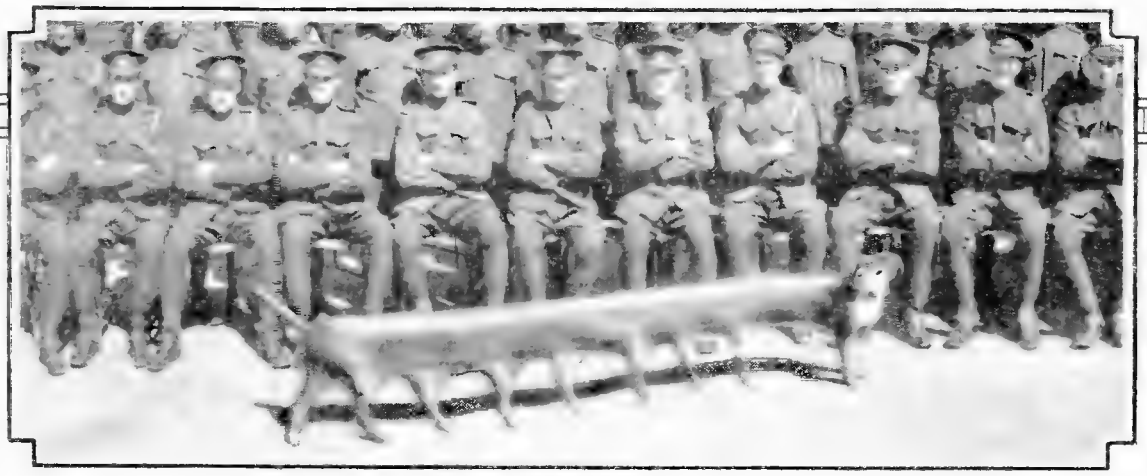


USE GOOD TIRE LOCKS & CHAINS AND DON'T PARK IN ALLEY

USE SECRET SWITCHES

An ordinary radio jack makes a good secret switch. It is placed in series with the ignition circuit. The plug is short-circuited with a piece of wire and attached to your belt by a string. As an emergency lock, remove the distributor arm.

IN EMERGENCY REMOVE DISTRIBUTOR ARM



The dog illustrated in the above photograph is the company mascot of No. 7 Draft, "C" Battery, R. C. H. A., of Kingston, Ontario. You may think this is a very curious natural anomaly, but the ten-legged dog here shown is very ordinary. It so happened that at the time this picture was taken, the dog moved along at approximately the same speed that the panoram camera moved; hence this rather curious result.

FIVE dollars will be paid for each distorted photograph accepted and published in this magazine. Many of the readers of this publication already have in their files some photographs which would serve these purposes. We desire photographs of distorted perspectives, not trick photographs obtained by double-exposure methods.

There were no signs of rain on the day when this photograph of the Brooklyn Bridge was taken, yet note the remarkable reflection, apparently on the roadway.

We wonder whether a man wheeling a wheelbarrow looks like this to a small dog. This is the view which the cameraman got when the camera was placed near the ground.

St. Patrick's Cathedral is one of the architectural beauties of New York City, yet it does not look exactly like this from a distance.

The photograph at the left is not a freak of Nature. This is the way the cameraman distorted the image of the cow, when he placed his camera too close to "Bossy," and also a little to one side.

←

A photograph of Frank S. "Skyscraper" Jaynes, Los Angeles' tallest policeman, who stands 6 feet, 9 inches. This view is a "worm's eye" view.

→

Send all photographs to—Editor Distorted Perspectives, Science and Invention Magazine, 230 Fifth Avenue, New York City.

DISTORTED PERSPECTIVES

Photography Can Be Made Even More Amusing By Employing Principles Here Outlined

If a camera is held close to a person's foot as that person is walking, or taking an exceptionally long stride, a rather peculiar and in fact, ludicrous result follows.

WHILE we have all seen photographs that were distorted because the legs or the hands were too near the camera, and while we know that this is a fault sometimes found, not only among amateur photographers, but also among professionals, little has been done toward specializing in distorted photography. Here and there an organization has made a set of mirrors with which distorted motion pictures were taken, or a few amateurs have attempted to photograph the distortions appearing in the curved mirrors at some of the amusement resorts. On these pages we show not only the method for the taking of distorted pictures, but some very fine examples of this work.

In order to further the interest of amateur and professional photographers along the lines of distorted photographs and in order further not to make them feel that any distorted views which they may take are totally worthless, *this publication will pay* $5.00 *for each distorted photograph accepted and published in this magazine.*

Referring now more particularly to the photographs on the opposite page and the manner in which they were taken, it might be mentioned that in the top photo of the accompanying mascot of No. 7 Draft, "C" Battery, R. C. H. A., of Kingston, Ohio, the picture, as usual, was taken with a panoramic camera. The lens barrel in a camera of this nature swings so as to take in the entire scene. It so happened that the mascot also decided to get his picture in the scene as long as possible and in his trying to keep pace with the lens, the curious result indicated on the opposite page was produced.

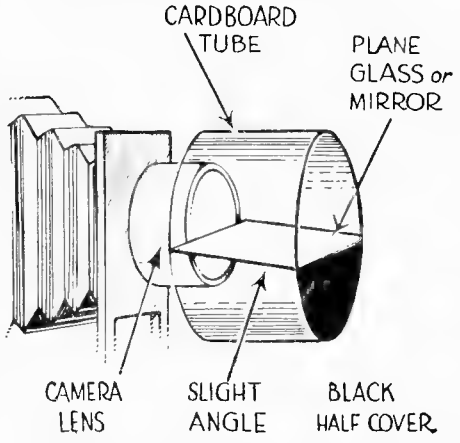
If you want to get a good picture of a tall building, do not get very close to it. The closer you are and the greater the angle at which the camera is held, the more distorted will the photograph appear.

Use Your Camera to Take Distorted Perspective Photos

Send these pictures to the editor of this publication. $5.00 will be paid for each one accepted and published.

DISTORTED MAN AND WHEEL-BARROW

ON the opposite page the reader will see a photograph of a man pushing a wheel-barrow, but he is so grotesque, that one wonders how a camera could possibly belie the perspective to the extent there indicated. There is a diagram on this page, upper left, showing how this was done. The



Photographs of persons or buildings can be taken in such a way as to produce the most perfect reflection imaginable. An example of a photograph taken in this manner is indicated on the opposite page.

camera was held near the foot of the subject and the picture was then snapped. The closer the camera is to the foot, the larger will this appear, so several experiments will have to be made before the result here indicated will be attained. It is well, in cases of this nature, to prevent the possibility of spoiling films or plates, to view the object to be photographed through the ground glass or in the finder.

DISTORTED BUILDING

THE closer one gets to a building, and the greater the angle at which the camera is being held, the more will the side walls of the building apparently converge. Columns of buildings that are absolutely vertical would thus appear to be tapered very greatly. Observe how the steeples of the church seem to be directed inward. The photograph was taken in the manner indicated on this page. No attempt was made to secure the result here shown, the purpose being to show up the architectural beauty.

REFLECTION PHOTOGRAPHS

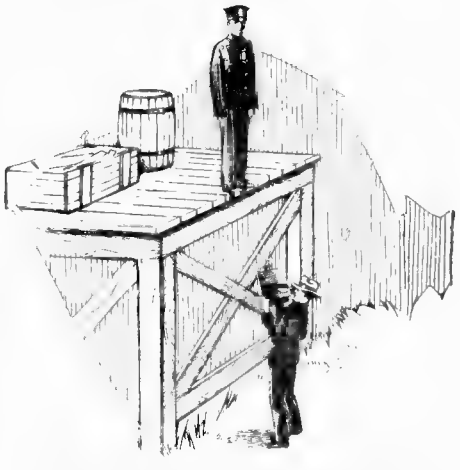
PERFECT reflections are photographically obtained by employing a very simple device invented by a New York cameraman. This consists of a tube arranged to be fitted over the lens. The tube itself is of a diameter greater than the lens, so that no part of it will show when the picture is being taken. An ordinary piece of glass is placed in the center of the tube, so that the front edge of

The circus would pay quite a sum of money for a cow with a head as big as the one shown in the picture on the opposite page. The photograph was taken by having the camera close to the cow, as here illustrated.

it is a little lower than the back edge or the end fitted against the lens. It will thus be seen that the glass rests in the tube at a slight angle. The bottom half of the tube is then completely covered with a piece of black paper. Any photograph of a building now taken will show a perfect reflection of the lower half of that building, in what is apparently a lake set in front of the building. Even an automobile on the roadway photographed with the aid of this device seems to be apparently running on a crystal clear lake, and producing a reflection of itself in the body of water on which it is running. There is a photograph of the Brooklyn Bridge shown on the opposite page. It would be impossible to secure a reflection of this portion of the bridge, unless atmospheric conditions were absolutely perfect and the roadway were flooded with a downpour of rain or a thin sheet of ice. Yet, by the pedestrian, one can see that no such event has taken place. The photograph was taken on a clear, calm day.

In building up an apparatus of this nature it is advisable to regulate the position of the glass in front of the lens, viewing the scene at the ground glass while doing so.

The distorted cow and the photograph of the distorted officer were taken as the diagrams on this page indicate. In the first, the camera was placed a little to one side of the cow's head; in the second, the photo was taken from beneath the boardwalk or some other suitable structure.



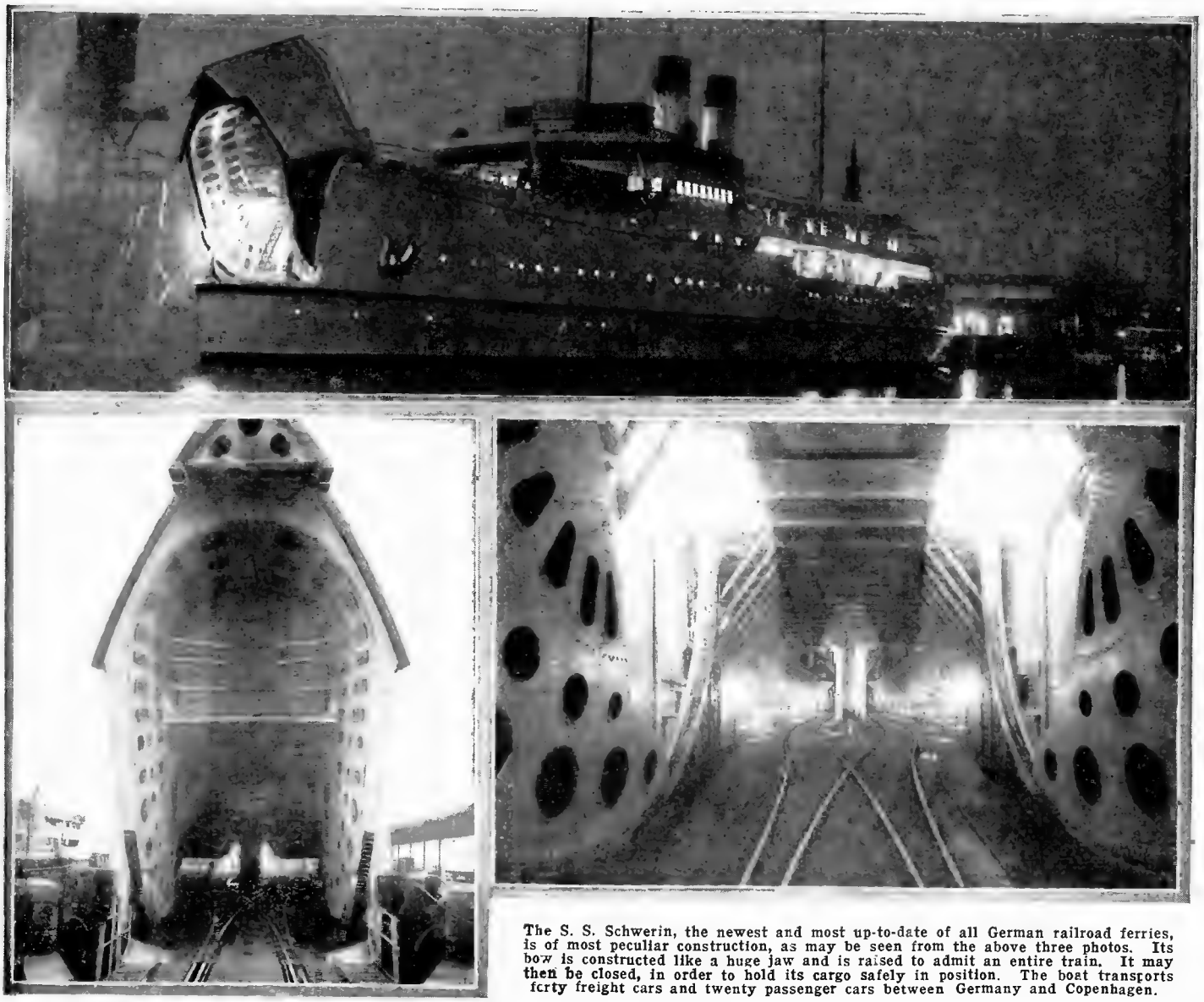
Look at Los Angeles traffic officer on the opposite page and then at the illustration above, and you will see how a picture of this nature can be taken.

Can You Answer These Questions

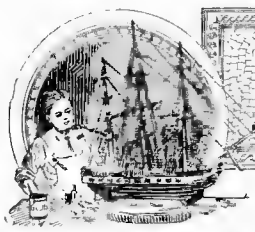
(Form your own answer before turning to page indicated)

1. How do you think spiritualistic mediums remove objects from a table in front of the "cabinet," and cause other physical phenomena to occur. (See page 200.)
2. How does the strong man in the circus side-show drive large nails through planks with his hand? How do the side-show performers walk up a ladder of swords, dance on broken glass, etc.? (See page 204.)
3. What method would you employ to photograph the undersea battle between an octopus and a bather, such as the encounter portrayed on our front cover? (See page 206.)
4. Do you understand how a motion-picture film was transmitted over a telephone wire between Chicago and New York, and shortly thereafter the reconstructed movie flashed on the screen of a New York theatre? (See page 207.)
5. Do you know that the law of averages may mean all the difference between success and failure in any business venture—from starting a tea room to operating a large hotel? (See page 212.)
6. How is it possible to produce a pressure of 200,000 pounds per square inch in a small apparatus for laboratory experiments? (See page 214.)
7. What scheme would you employ to prevent fruit trees from budding too early in the spring, thus making them liable to damage by frost? (See page 216.)
8. How would you apply compressed air in order to break up wave action along the sea coast, when it becomes dangerous to hotel and other property? (See page 218.)
9. By means of what simple device, costing but a few cents, would you attempt to make photos of imitation water reflection scenes, and other startling photographic effects; all with an ordinary camera? (See page 228.)
10. Describe the simplest form of electric furnace for home laboratory experiments. (See page 234.)
11. Do you know how to make home-made fireworks simply and safely? (See page 235.)
12. Can you explain how it is possible for the human voice to be "scrambled," for transmission over a telephone or radio circuit, and finally to be "unscrambled" and reproduced perfectly at the far end of the circuit? (See page 245.)

Giant Ferry-Boat Hauls Trains



The S. S. Schwerin, the newest and most up-to-date of all German railroad ferries, is of most peculiar construction, as may be seen from the above three photos. Its bow is constructed like a huge jaw and is raised to admit an entire train. It may then be closed, in order to hold its cargo safely in position. The boat transports forty freight cars and twenty passenger cars between Germany and Copenhagen.



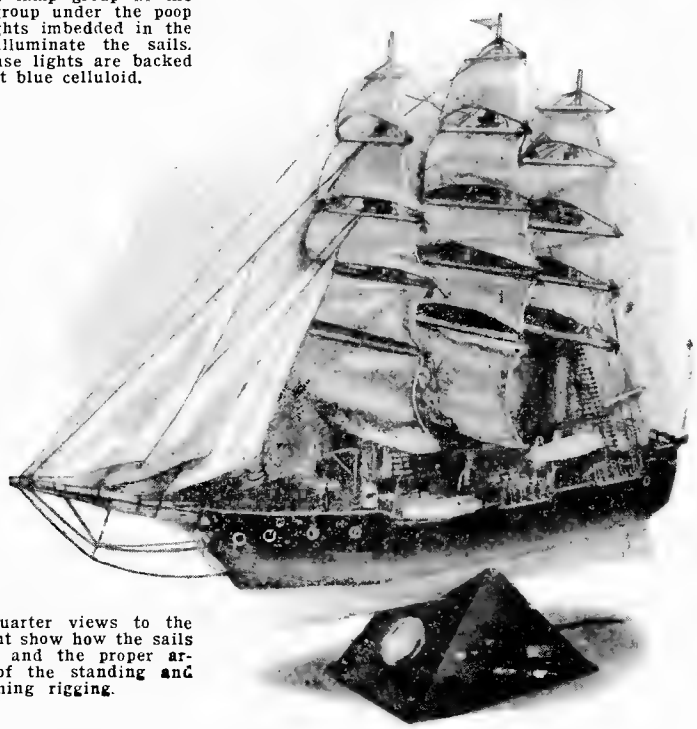
Model Department

Full Rigged Ship

THE trophy-winning model of this month's contest is an excellent replica in miniature of a typical full rigged merchant ship. The model is two and one-half feet high without the base, three feet in length, and has a seven-inch beam. The hull has been cut out of a block of wood in preference to the more complicated plank and beam method of hull building. We wish to point out that an electric lighting system is incorporated which provides a novel and pleasing lighting effect. The base lamps provide a blue light for the hull. The lamps beneath the foredeck shine through the portholes and light up the port and starboard lights. The lamps beneath the poop deck illuminate the windows of the chart-house and wheel-house. The sails are illuminated by the two lights imbedded in the main deck. These lights and the two in the base are constructed from flashlight parts.

Above: A photograph of the "Star of Science" and the cup which was awarded to the constructor.

The illustration at the left is a close-up view of the mounting base. A step-down transformer is contained within the base and supplies power to the hull illuminating lights, and to the two contact plugs. The contact plugs fit into sockets in the keel of the model, and wires run from these sockets to the lamp group at the right, to a similar group under the poop deck, and to two lights imbedded in the main deck which illuminate the sails. The lenses of the base lights are backed with transparent blue celluloid.



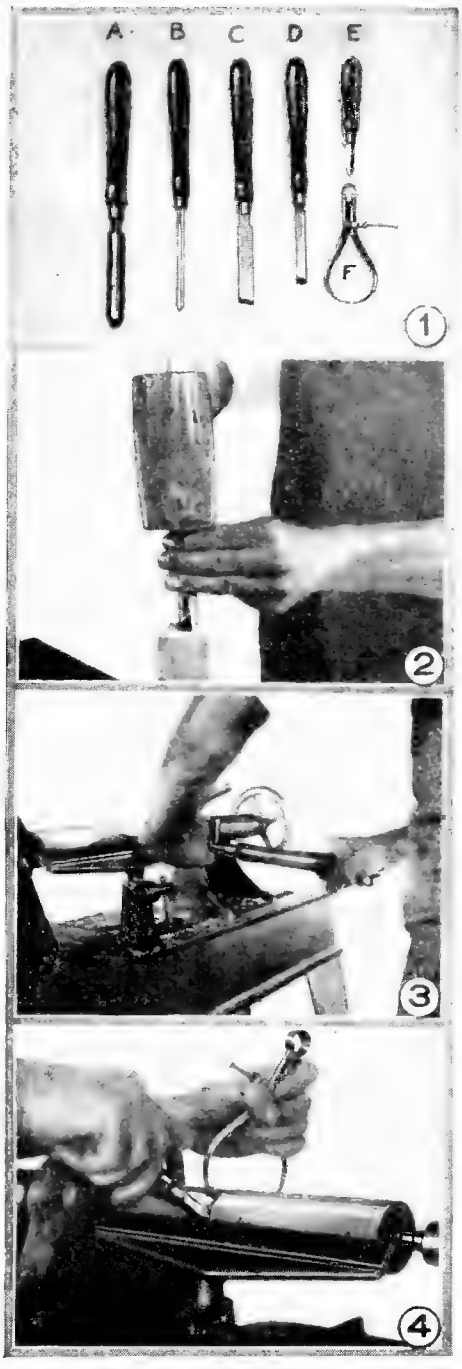
The three-quarter views to the left and right show how the sails are carried, and the proper arrangement of the standing and running rigging.

(*See rules for Model entries on page* 255)

Wood Turning

This is the First of a Series of Articles Dealing with

By H. L.



In photograph No. 1 at the top of this column, there are a few tools which are indicated for wood-turning. More tools will be added to this group as they are needed. A, shows a large gouge; B, a small gouge; C, is a large skew chisel; D, a small skew chisel; E, is what is known as a parting tool; and F, a pair of outside calipers.

Photograph 2 shows the method of centering stock and setting the spur center. A wood mallet is used for this purpose.

In photograph 3 we see the operation known as a roughing cut. Note particularly the position of the hands and the tool. The work is handled from the center outward toward both ends.

In order to size to diameter, the method indicated in photograph 4 is used. The calipers being adjusted to the predetermined diameter, the parting tool is used until the proper depth has been secured.

The illustration at the right shows some of the first lessons in wood turning. Dimensions are given and the position of the tools clearly indicated.

THE LATHE

FOR the man who enjoys tools and working with tools, there is nothing that can take the place of the home workshop for recreation, and as an avocation which may prove to be very profitable. In this day of cheap and accessible power the home shop, no matter where its location, can easily be equipped with power machines at relatively small cost.

Perhaps the most interesting of all wood-working machines is the lathe. It comes down to us in very crude form from ancient times, when early craftsmen, wishing to fashion other materials than the plastic clay with which they worked, evolved the turning lathe somewhat after the form of the potters' wheel, which preceded it.

In later times we have a period in which wood-turning flourished, and many are the antiques of turned mahogany and walnut of our own early American days that fairly make our mouths water with desire, as we see them in shop and home. Early craftsmen made up for imperfections in machines by amazing skill and patience, and the power used was that commonly known as "elbow grease." But modern artisans, working with modern machines, can accomplish fully as beautiful results with much less labor and in a shorter time than our grandfathers ever dreamed possible.

EVERY HOME WORKSHOP NEEDS A LATHE

THE home workshop without a lathe is incomplete. One can purchase a small lathe at very moderate cost or with sufficient ingenuity, one can be built from a junk sewing machine. Perhaps, sometime it will be our privilege to present the construction of such a machine to the readers of SCIENCE AND INVENTION.

There are already many owners of lathes, however, who are following very craftsman-like methods in turning, and so in this, and following articles, an attempt will be made to present in the clearest manner possible, correct methods for doing ordinary turning, with attractive designs for useful articles, followed in the later numbers with some "fancy" turning.

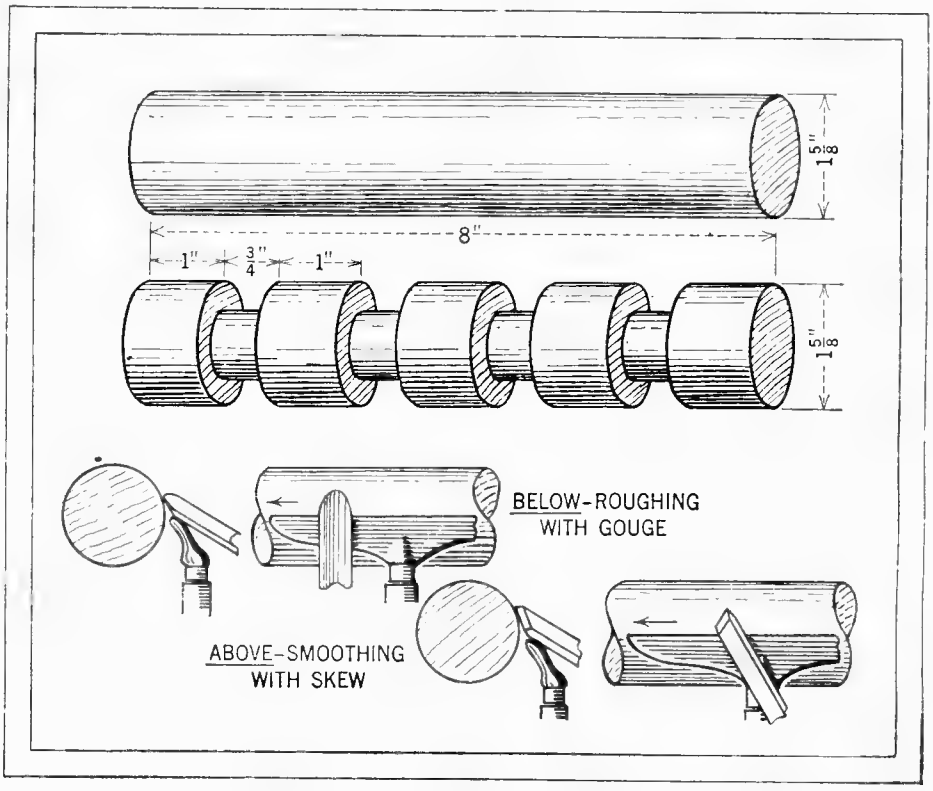
Practice does the trick. It is well to take the exercises given in this article and practice until perfection is attained. Turning tools are tricky; unless, and until, skill of manipulation masters them. Nervousness and uncertainty will make them do all sorts of curious things; and a little unsteadiness will probably mean a chunk torn out of a rapidly revolving piece of wood. Just remember in beginning work on a lathe, that although it may look dangerous, there is very little chance to get even a slight hurt, and it is without question the safest of wood-working machines.

Like all other tools, it must be kept in good condition for successful operation. Keep in mind that a good grade of oil, applied at regular intervals to the bearing surface of the lathe, and sharp tools, will go a long way toward making a skillful artisan.

LATHE TOOLS

A FEW suggestions, then, as to tools and their care may be in order. Few tools are necessary, but they should be good ones. To start with, one should have ½" and 1" turning gouges; ½" and 1" skew chisels; a parting tool; outside calipers; and a slip stone, which should be kept on the lathe or near at hand for frequent use.

In sharpening the tools an emery wheel is almost essential. A small stone may be purchased and mounted with a screw collar to revolve on the lathe. All of the tools should be ground and whetted to razor-like edges; being careful to keep the chisel edges straight and at the correct angle. Remove



For The Amateur

the Art of *Wood-Turning* in Its Various Branches

WEATHERBY

all burr or wire edges from inside of gouges with the slip stone.

Having sharpened the tools we are now ready for work. Cut a piece of 1⅞" x 1⅞" stock to 10" in length. Any wood will be satisfactory, but poplar or other close-grained, medium soft wood will answer the purpose better for beginner's use, than harder or softer woods. With try square or rule, lay off diagonals on the two ends of the piece, then removing the live or spur center from the lathe, and using a mallet, drive the center into the wood far enough for the spurs to catch and hold.

FIRST OPERATIONS

PLACE the material in the lathe, and turn the stationary or dead center tight against the center of the opposite end of the material, or until the cup cuts into the wood. Loosen very slightly and place a drop of oil at this end on the cup center to reduce friction. Lock in place and we are ready for the actual turning.

The lathe, of course, should be of variable speed, and we should start with the slow speed for roughing off the outside corners of the block. The illustration shows the correct method for holding the gouge. Care should be taken to hold the handle of this tool low and the cutting edge should be held at a slight angle to throw the shavings away from the operator's face. The tee-rest should be adjusted so that the top will be on a line with the centers and close to the stock. Now putting the lathe into motion, and with the large gouge held as illustrated, rough off the square corners, turning the gouge over as we work from the center of the block, first in one direction and then in the other.

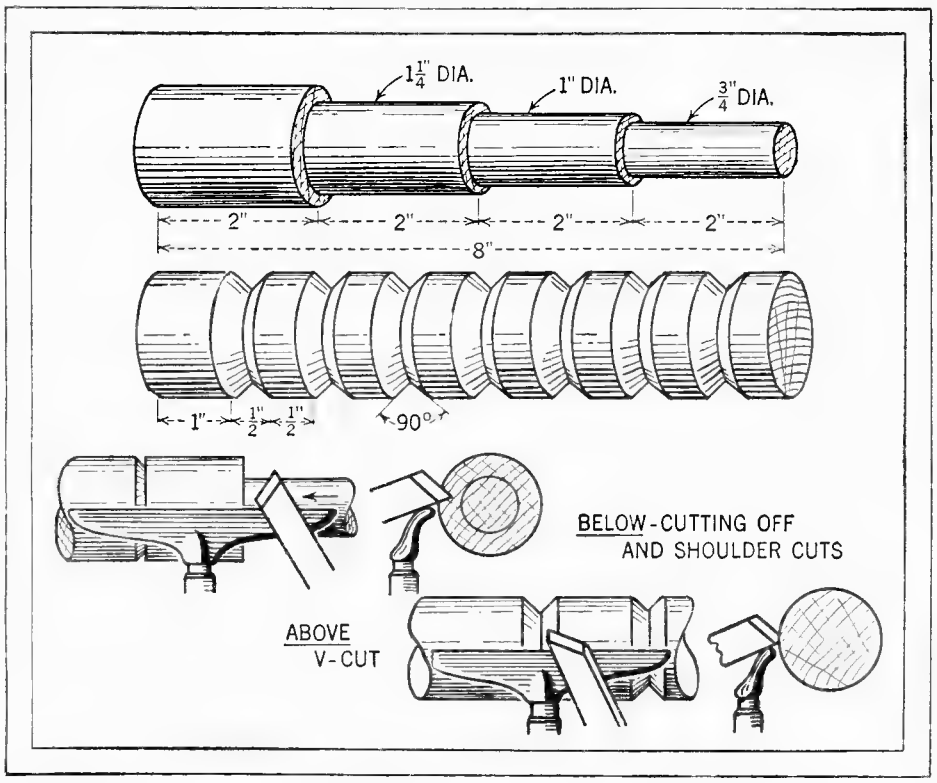
FINISHING OPERATION

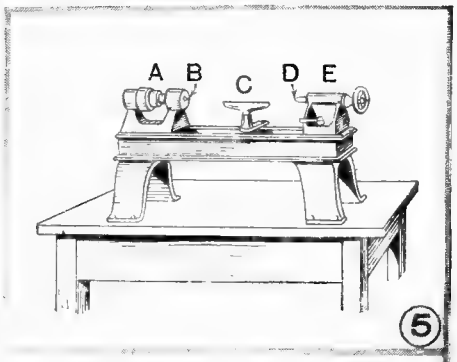
WITH this roughing off finished, we are ready for the more difficult operation of smoothing down to cylinder dimensions, using the large skew chisel. First, move the tee-rest nearer to stock, and with the parting tool and outside calipers set to 1⅝", held as illustrated, cut down to dimensions in two or three places. Shift the lathe to high speed, and with the skew chisel held as shown, being careful that the point does not catch and "hang up" in the wood, smooth down to the bottom of the grooves made by the parting tool. In this operation, hold the chisel so that the center of the cutting edge does the cutting. Avoid scraping with this tool.

Following this, we are ready to cut our cylinder off to length. Placing a rule on the tee-rest and with the block in motion, measure off and mark with a pencil, the length of 8". Either the parting tool or the small skew chisel may be used in cutting off, but for this exercise we will use the chisel. Turning the chisel so that the edge is supported on the tee-rest, with the point of the chisel down, shove it into the revolving cylinder at right angles on the pencil line to a depth of about ⅜". Now, turn the chisel at an angle cutting in and down to the depth of the grove, forming a V with the inside vertical. Rough off the unused end with the gouge and repeat the process of cutting until an approach is made to the center, or a spindle about the size of a lead pencil is left at both ends. Care must be taken to keep the ends square and smooth; and also not to allow tools to come into contact with the live center. Sufficient room should be allowed on this end to prevent such an event happening.

The final cutting may be done with a back saw, or the cylinder may be cut off entirely on the lathe if care is taken; cutting a little at a time at each end until a very small diameter is left, and finally cutting through on the live center end, leaving the other end attached by a small neck which can easily be cut off with a knife.

(*Continued from page* 255)





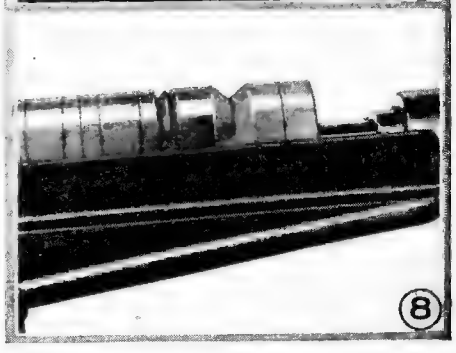


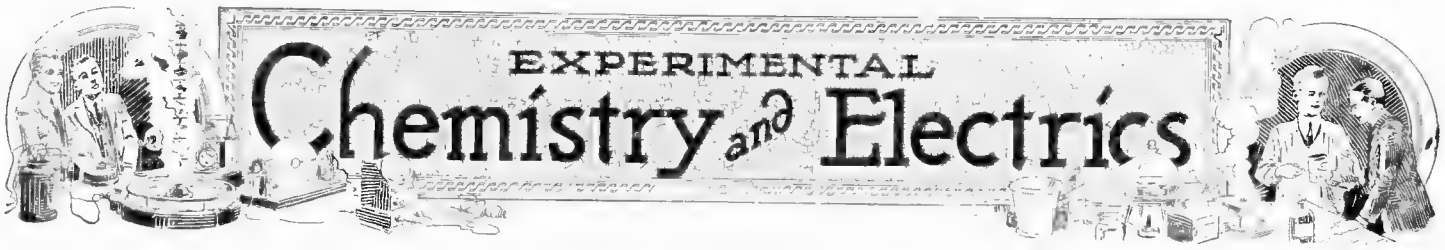
Illustration 5, at the top of this column, shows a small bench lathe. The letters refer to the following parts: A is the head stock; B, the live center; C, is known as the T rest; D, is the dead center; and E, the tail stock. These parts can be quickly and easily memorized, so that the novice will understand which portion of the lathe is referred to when any of these terms are mentioned.

Photograph 6 is an indication of a plain finish cut. In this, a large skew chisel is employed, the center part of the skew chisel being used as the cutting edge. Again the work is done in both directions, starting at the center, and working out therefrom.

When measuring a piece to length, for cutting off, the work should always be in motion. The method of doing this is clearly illustrated in Fig. 7, where the ruler is held on the T rest.

Photograph 8 shows a V-cut. One of them is completed, and the second has been started. **Wood turns toward tool.**

The illustration at the left shows how V-cuts are made and the tool held for the purpose, and gives several other wood-turning principles.



Home-Made Arc Furnaces

By ROBERT L. LEWIS

A GREAT deal of interesting work and experimentation can be carried on by the experimenter if he has a high-temperature electric arc furnace. Little difficulty should be experienced in building such a furnace, since the necessary materials are not hard to obtain. The carbon electrodes may be arc-light carbons secured from the local power company, or from some supply house. Some types of radio batteries have long, thin electrodes, which are suitable if carefully removed from worn-out cells. Fireclay is obtained from any large supply house or, since it is used in every foundry, it may be procured there.

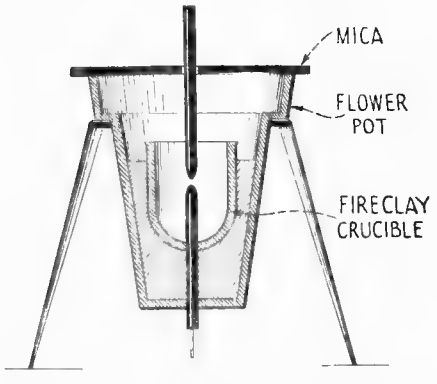


FIG. 2

A simple carbon arc furnace with crucible for holding the metal is illustrated above. The interior is lined with graphite.

The simple carbon arc furnace can be made in several shapes, sizes and forms, depending upon the use of the furnace, the materials used, etc. For fusion and reduction of metals, types 1, 2 or 3 may be used (see illustration). In types 1 and 2 the metal is placed in the small crucible, which is made of either graphite, alundum or fireclay. In type 3 the metal is contained within the furnace itself, and the molten metal is drawn off at the carbon tap hole. Carbon is used, so that the metal will not adhere to it. Types 1 and 3 are made of fireclay, water glass and shredded asbestos. It is best to use a wooden box for a form. After packing the mixture into the box in the desired size and shape (the inside should be relatively small, for the less the volume to be heated the greater the efficiency) it is set above a furnace to dry slowly. To withstand the heat the rough inside is given a coating of graphite cement, made of graphite (or ground-up battery carbons) and fireclay; 3 parts of graphite to 1½ of fireclay. This, also, is allowed to dry slowly.

For making calcium carbide, carborundum, or any compound of carbon, the triple-series carbon resistance furnace (No. 4) is used.

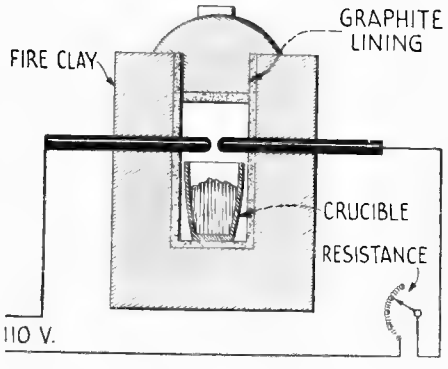


FIG. 1

Above is another type of furnace made with a flower pot. The crucible shown may be made either of graphite, alundum or fireclay.

This furnace can be made as above, by a wood form, or of fireclay slabs (they need not be coated with graphite), held together by thin sheet metal. Three carbons on each side are used, as shown.

WORKING WITH FURNACES

IN working with metals in arc furnaces 1, 2 and 3, the difficulty will be in the rapid oxidation of the metal, caused by the ozone which is usually generated by the arc. To remedy this an excess of powdered charcoal must be used to unite with oxygen, forming carbon dioxide. Borax can also be used to fuse and cover the metals in the neutral atmosphere. Nearly all the metallic oxides can be reduced to their respective metals in furnace 1 or 2. Aluminum oxide (the white precipitate formed when ammonium hydroxide is added to strong alum solution) may be reduced to aluminum by introducing an intimate mixture of the oxide and graphite into the series resistance furnace 4. Iron oxide, cupric oxide, etc., may be reduced in a like manner. To make calcium carbide in the series furnace: reduce 18 ounces of good unslaked lime to a powder in a mortar, next grind 16 ounces of coke or electric-light carbons to a fine powder (this can be done in an old coffee grinder, then sifted through a flour sieve). Four or 5 ounces should be fed to the furnace at one time, the rest put away in air-tight cans. It will take about 20 minutes with a 3½-inch arc. Carborundum can also be experimented with by using about 8 ounces of the following: sand, 12 ounces; coke dust, 6 ounces; sawdust, ¾-ounce; salt, ¼-ounce.

Of course suitable resistance must be used. The best is the sliding contact rheostat, so that the arc is not extinguished. Thirty-ampere fuses should also be used, but above all, wear smoked glasses when looking at the arc.

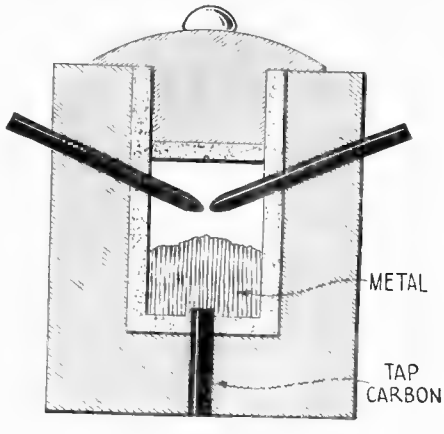


FIG. 3

In the type of furnace shown above, the metal is drawn off at the carbon tap hole.

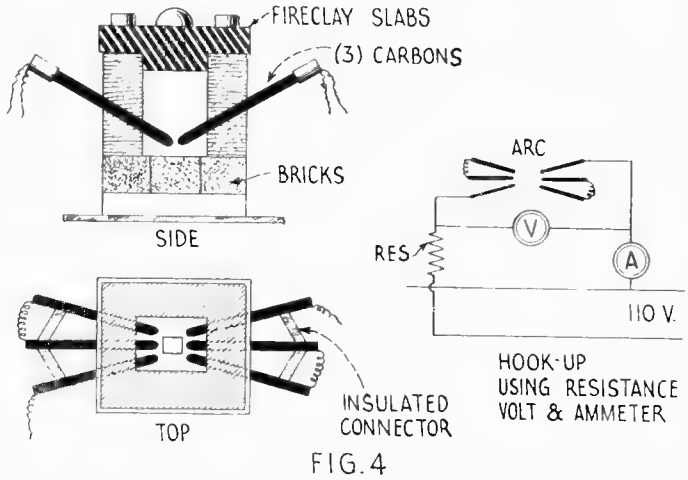


FIG. 4

For making calcium carbide, carborundum and the like, the triple series carbon resistance furnace is used. The construction is shown above.

REMOVING STOPPERS

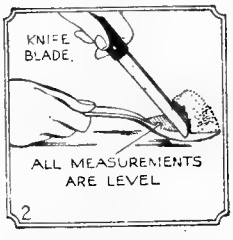
Reagent bottles holding caustic alkalies, alkaline carbonates, etc., very frequently become fixed, and the usual method has been to tap the stopper with a wooden block or apply heat to the neck, often with disastrous results. This method may be tried. Freeze the stopper so as to cause a contraction of the stopper from the neck. The bottles which were used for experiment had failed to open under the heat and tapping, and were bad cases of fixed stoppers. The bottles held sodium carbonate that had formed sodium silicate, an excellent cement, and so were firmly fixed. They were inverted in a mixture of crushed ice and calcium chloride—taking care that the freezing solution did not touch the lips of the bottles. After standing twenty minutes, the stoppers were removed without the slightest exertion. This is the new best and safest way to remove stoppers from bromine bottles and other corrosive chemicals.—*Contributed by F. A. Jusaites.*

Home-Made Fireworks

By E. R. HAMBURGER, Ph.D.

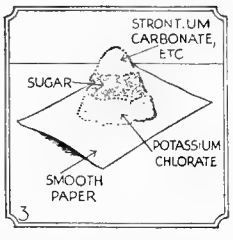
WHIZ BANG! Another Fourth of July is ushered in with all the traditional fun and excitement of crackers popping, pinwheels whirling, rockets rising, and magnificent scenic effects in colored flames. Do any of us stop to realize that these celebrations, which in our twentieth century are accepted in such a matter of fact fashion, date back thousands and thousands of years to ancient Chinese civilization.

Any sort of measuring device can be employed in the making of fireworks, but the same measure should be used for all chemicals.

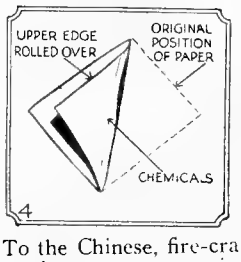


In order to assure accuracy, all measurements are level. They are leveled by scraping off the surplus with a knife.

For, inasmuch as the earliest records of fireworks are found in Chinese writings, it is commonly believed that they were the first inventors and exploiters of pyrotechny (the art of fireworks). Generation after generation, they have gone on making fire-crackers.

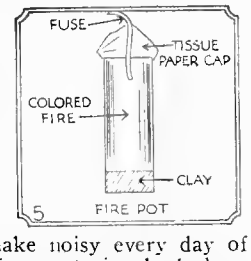


Never mix the chemicals with any sort of stirring rod. Pile them up on a piece of paper, as shown in this illustration.



The chemicals are mixed by grasping a corner of the paper and rolling this over as this diagram shows. Repeat with the other corners.

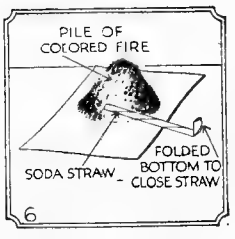
To the Chinese, fire-crackers are appropriate to almost every occasion. They often play a conspicuous part in hospital rites. They crackle merrily at wedding celebrations and birthdays. They make noisy every day of rejoicing. Mandarins centuries back have been entertained by spectacular effects in colored fire, or by innumerable scenic displays.



This diagram illustrates the construction of a fire pot. It may be constructed several weeks before it is to be used.

Moreover, in China, fireworks are believed to ward off evil, and to woo good influences. Indeed, the coarse bamboo paper used in their manufacture is purposely colored red because this hue attracts good fortune, according to the Chinese superstition. In passing it is interesting to note that today, besides consuming an enormous amount of fire-crackers herself, China annually exports over $3,000,000 worth.

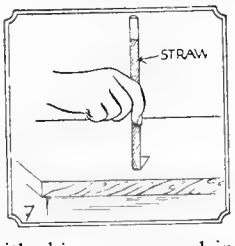
Perhaps the simplest form of fireworks is the colored fire. Bengal lights, firepots, and the flares used for signal purposes during the world war are all variations of this type. They have been used in displays by the ancient Romans, in the middle ages in Italy, and later in France and England. At the time of the crusades it was the custom in Italy to celebrate the various feast days by vivid pictures in flame of some sacred story appropriate to the saint whom it was desired to honor. Huge figures of gigantic size were erected on movable platforms so that their positions could be shifted by means of ropes and pulleys to suit the action of the drama. The figures were so equipped that fire might issue from the mouth or eyes or nostrils, and that the blades of swords, spears, battle axes or other weapons which were brandished might be of living flame. In addition, the scene was decorated by a system of pipes, arranged so that either balls of colored fire, or streams of flame were thrown out.



A good way to make colored fires is to use ordinary soda straws, fold the bottom over and fill as shown.

COLORED FIRES

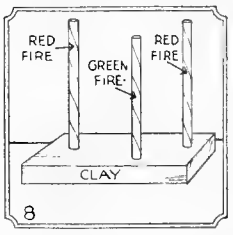
IT is well within the power of the amateur chemist to make these colored fires in his home laboratory. The chemical principles are quite simple. All fireworks contain a salt which decomposes readily to produce oxygen, some combustible material which will combine with this oxygen, and in so doing will burn, and the substances which give the individual fireworks its characteristic, which may be a salt to color the flame. In the colored fires which we shall make, the source of oxygen is potassium chlorate, and the combustible material sugar. Strontium salts will color the flame red; copper salts blue, and sodium salts yellow.



After pushing the straw into the colored fire chemical, it is then tapped to compact the substance within.

PRELIMINARY INSTRUCTIONS

BEFORE giving directions for the preparation of any particular firework, there is one caution which I would like to impress upon my reader. Remember that you are dealing with highly explosive materials. Before they can be used they must be ground to a very fine powder. Under no conditions should more than one chemical be ground together. Always use a porcelain mortar and pestle, and never metal, for the latter generates too much heat. It is safer, if possible, to purchase chemicals already powdered. Again, let me repeat: NEVER GRIND TWO OR MORE CHEMICALS TOGETHER. CLEAN MORTAR CAREFULLY BEFORE GRINDING A NEW CHEMICAL. Prepare materials immediately before using, thus eliminating any danger of spontaneous combustion, or of dampness settling in.

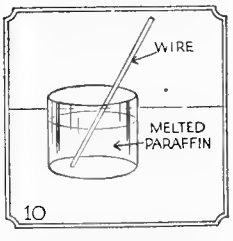


The straws can be imbedded in clay as here shown. Do not put them too close, as the smoke of one will interfere with the color of another.

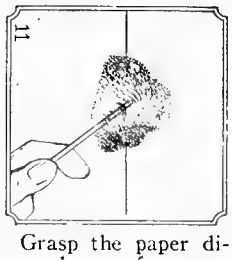
Powdered iron, when mixed with gun powder, produces brilliant sparks. The sparks are due to the burning bits of metal.

MEASUREMENTS BY VOLUME

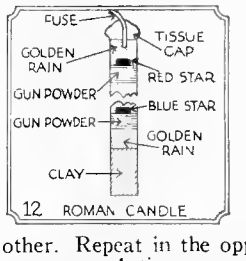
SINCE few home laboratories boast of a balance, measurements will be given by volume rather than by weight. Always level the top of your measure. Chemicals should be mixed as follows: As each chemical is measured, dump in a pile in the center of a large square sheet of paper, one chemical on top of the other. Grasp the paper diagonally, and roll over and over from one corner to the other. In this manner the particles of material are rolled one with the other. Repeat in the opposite direction. Repeat several times, never rolling the paper twice in succession in the same direction.



Sparklers are produced by first dipping a piece of wire in melted paraffin as here illustrated.



The rod is then rolled in a fountain mixture. The chemicals are held to the surface of the rod by the paraffin coating.



The illustration at the left indicates the construction of Roman candles. Note that there is ample space around the stars.

A FIREPOT

TO make a firepot, first prepare the paper case by rolling a medium-weight paper

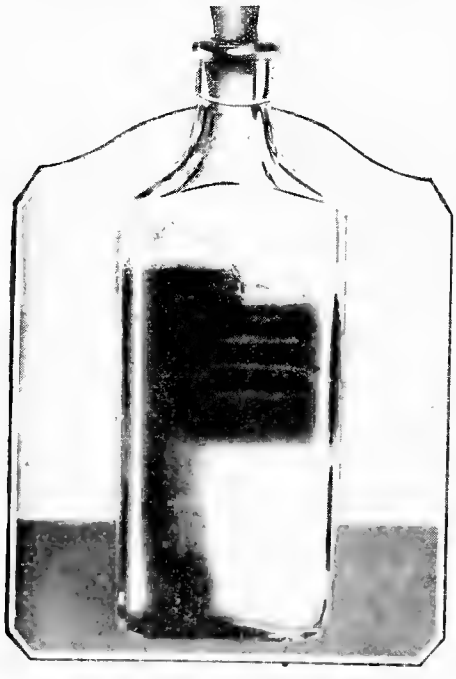
(*Continued on page* 252)

Some Chemical Experiments with Light

These Simple, Yet Very Puzzling Phenomena, Will Prove Instructive and Entertaining

By RAYMOND B. WAILES

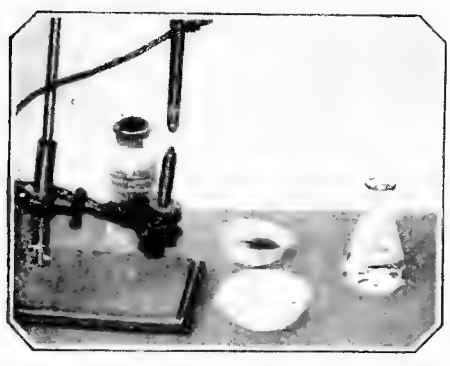
THE chemical experimenter should not think that experimenting with actino chemistry, or the chemistry of light is costly, due to the fact that silver salts are used. Some of the commoner metals, such as copper and iron, and many organic chemicals, even sugar under certain conditions, can be used in various combinations which are affected by light.



How the gelatine-lead acetate gel looks, after diffusion has proceeded.

One of the most simplest experiments showing the chemical decomposition of a substance under the action of light rays is that of the breaking down of ammonium thiocyanate when exposed to the light from an arc lamp. This chemical, easily soluble in water, when insolated, or when exposed to the radiations from the carbon arc, changes from a colorless or water-white solution to one of a reddish color, so red at times that it can frequently be mistaken for red ink.

One of the photographs shows how the solution should be exposed to the rays. The arc produces some ultra-violet rays, or at least, some rays which are so short in wave length that the decomposition of this easily procurable chemical is effected. Fresh solutions should be used. During the decomposition a gas is evolved and the solution turns red. The solution will turn red even if it is contained in a glass vessel such as a bottle. This indicates that some of the wave lengths of light a trifle longer than those in the ultra-violet region are at work, for it is well known that glass absorbs ultra-violet radiations. It is believed that the products of the reaction are ammonium cyanide and colloidal sulphur, the small particles of the latter causing a dispersion of light and thus the solution appears red. If the red solution stands for a while the color fades. It is thought that the small particles of sulphur coalesce or combine to form larger ones and thus the red color ceases to appear.



The electric carbon arc is a good substitute for sunlight in many photo-chemical experiments.

If a 1% agar-agar or 4% gelatin solution is made and 1% lead acetate added and the mixture is poured into a bottle it will gel or set solid when cold. Now if a solution of potassium bichromate is poured on top of this white gel and allowed to stand for a week or two, the dichromate will diffuse downward into the gel and cause a precipitate of lead chromate to form, which is yellow. Viewing the gel now shows that bands or different shaded layers are present in the gel. If half of the bottle is painted black with stove pipe enamel, asphaltum or tar so that one-half is not illuminated while the diffusion takes place, the portion so darkened fails to produce the bands. Ordinary cooking gelatin can be used in this experiment.

A 2% solution of sugar (sucrose) in water suffers no change when isolated or exposed to sunlight. However if 25cc of this solution are taken and about 2cc of a 2% solution of uranium nitrate or acetate are added, the solution will become colored violet or green when exposed to sunlight, Aldehydes are among the products formed. It would seem at first sight that the action of the uranium compounds is catalytic, but this is probably not the case.

Realgar, or red arsenic sulphide, a basis for several of the war-time smoke screens, will undergo decomposition when exposed to light. The change here is from orange red to reddish yellow, with the formation of arsenic trioxide and another sulphide of arsenic.

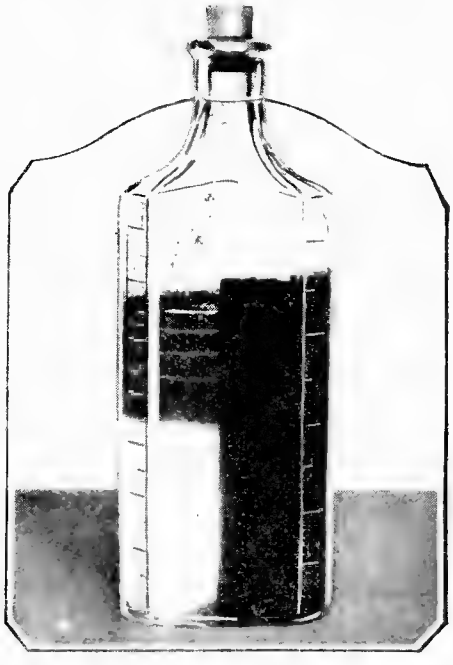
Iodoform dissolved in chloroform changes from a water white liquid to a brownish one when exposed to light. The change here is caused by the liberation of iodine, which dissolves in the choloroform. If the solution is removed from the light it will still decompose. If a drop or two of this decomposed solution is added to a fresh solution of iodoform in chloroform, the fresh solution will undergo decomposition.

Sugar can be decomposed by light, using substances other than uranium salts. If sodium tungstate and hydrochloric acid are added to a sugar solution, decomposition will occur with the formation of a blue solution, when exposed to the light.

Silver chloride, AgCl, shaken with benzene in the light, will become discolored, but if the benzene is not employed and the silver chloride is exposed alone, the discoloration will occur but will not proceed as rapidly as when the benzene is used. The reason for this is that the light decomposes the silver chloride and the benzene combines with the chlorine as fast as it is formed and it is well known that removing one of the products of a reaction speeds up its completion.

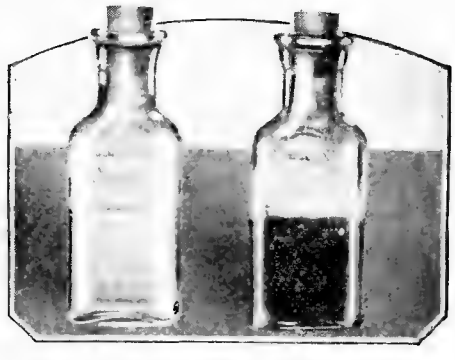
The effect of light upon the rate of settling of suspensions of clay and other substances has been studied and it has been noted that such suspensions settle out faster when exposed to light than when kept in the dark.

Sulphur dissolves in carbon disulphide. If such a solution is made and filtered and some is placed in each of three test tubes, one test tube being immersed in a copper sulphate solution, another in a potassium dichromate solution and the remaining tube unshielded, all three tubes beng placed in a strong light, the unshielded tube and the tube immersed in the copper sulphate solution will show a cloudiness due to the formation of amorphous sulphur which has precipitated out of solution. The dark colored dichromate acts as an absorber for certain of the radiations composing light and hence the tube within it is not affected.



Scraping away part of the paint shows that the gel underneath which was not exposed to the light did not develop the layers.

In exposing solutions to the light it is always best to use a control tube kept in the dark for a color standard. This is best done by thoroughly mixing the solution to be tested for light decomposition and pouring half of the solution into two tubes, keeping one tube in the dark, and exposing the other tube.



Left: Bottle of iodoform dissolved in chloroform. Right: The change which has occurred after exposing to the light.

Camera-less Photography

By C. A. OLDROYD

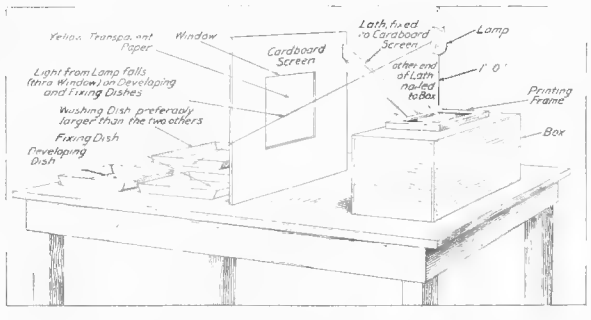
Pictures Taken by Direct Contact Printing Methods

"THEY must have been taken with an exceptionally good camera and lens," remarked a friend of the writer's when he was shown some nature-prints, similar to the examples given on this page; and yet—no camera had been used at all!

From suitable small, flat objects, as for instance, lace, leaves, feathers, small insects, moss, and numerous others, perfect reproductions can be quickly made by anyone who is familiar with gaslight or contact printing.

Briefly, this method consists in discarding the camera altogether and making a silhouette or shadow print directly from the article in question. The work is best done at night, or else in a darkened room.

The only equipment needed is a printing frame fitted with a clear glass plate measuring either 7 by 5 in. or 5 by 4 in., some sheets of gaslight or contact printing paper, three photographic dishes large enough for the paper handled, and the usual developing and fixing chemicals.



The illustration at the right shows a suggested workbench layout to be used when making camera-less photographs. With this method, the camera is discarded and a shadow print is made from the article.

As will be seen at the left, the only equipment necessary is a printing frame, some gaslight paper, three photographic trays and the usual developing and fixing chemicals. The work-table is best divided into two sections as shown.

To carry out the work in comfort, we can divide our work table into two sections, as shown in the illustration. The right hand side serves for printing, at the left is the developing section. We cannot place the paper in the printing frame in the full glare of the electric lamp, the left hand side of the table is therefore darkened by a large cardboard screen. This can be held in position by a wood strip, the other end of which is either clamped to the table or nailed to the box carrying the printing frame.

A window measuring about ten by eight inches is cut in this screen and a sheet of yellow transparent paper pasted over the opening. We now have a safe light which illuminates our developing section. The window must be cut at such a height that the light from the lamp falls on the dishes.

We now make our first nature print; on the clear glass plate in the printing frame we place the subject to be printed, for instance, a feather. Over it we place a sheet of printing paper, film side towards the glass plate. Next may come a piece of flannel or other soft material cut to fit the printing frame. This prevents pressure marks on the paper, in case the feather is forced against the paper with too much force.

The printing frame back is now closed, we may have to ease off the springs a little since we have a greater thickness in the frame than it was built for. Now expose the frame to the light, placing it about a foot from the lamp. To bring the printing frame closer to the lamp, a box can be placed on the table as shown. For a start, try an exposure of thirty seconds, with a little experience the correct exposure can be easily gauged, or use small strips a half inch wide for the first tests.

It only remains to develop the print at the darkened left hand side of the table. Place the print in the developer, the picture will gradually appear and be completely developed in a minute or so. Transfer the print to the washing dish, in which it should be left merely a second, and finally into the fixing bath.

The fixed print can now be inspected in brighter light, if the result looks flat, and shows but little detail, the exposure has been too short.

Expose twice as long for your next attempt, if it should resemble the second feather illustration at the right, the object will require a still longer exposure. Double the time of exposure once more, and you will obtain a faithful picture of the object which shows the finest details as in the last picture.

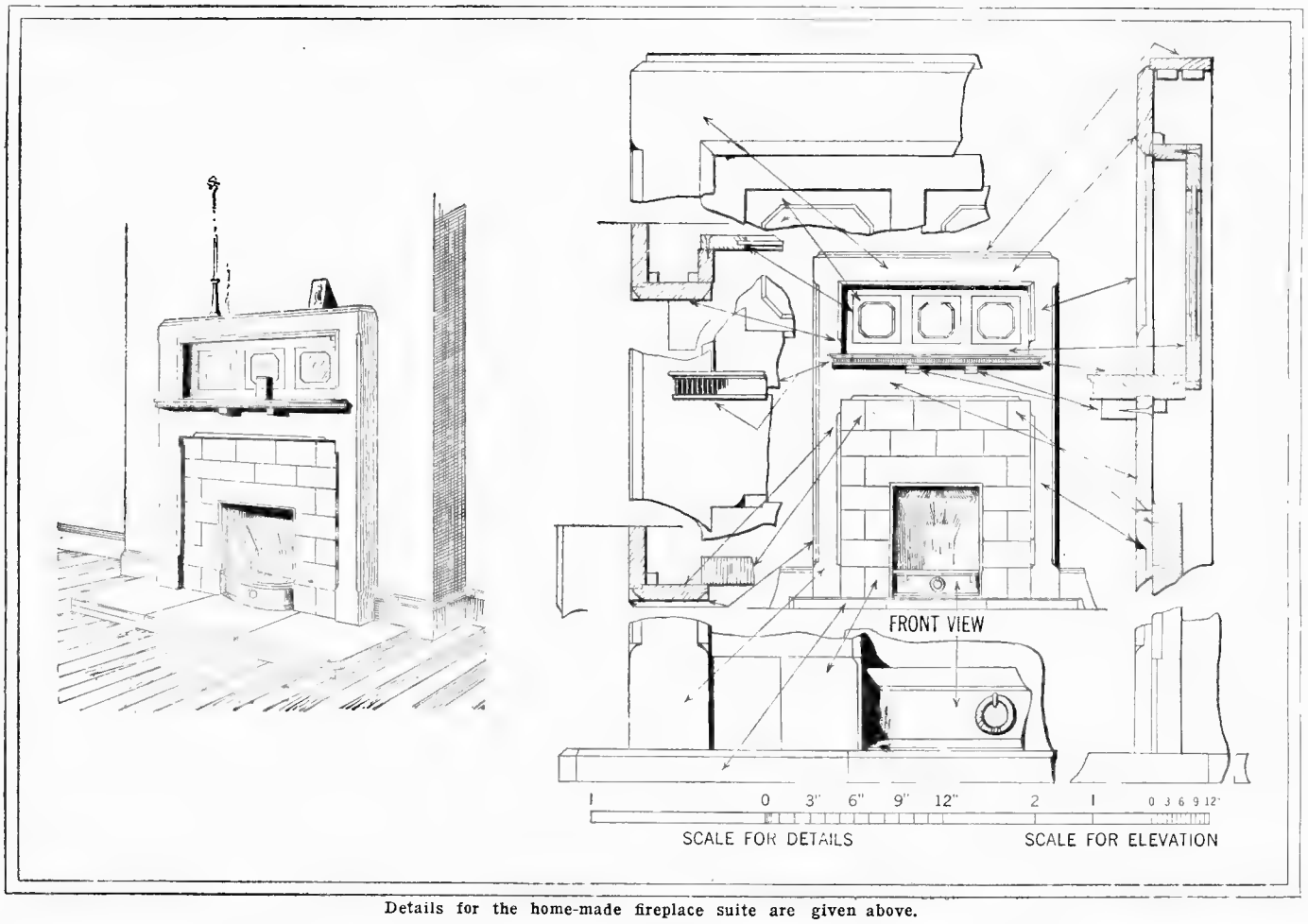
The only difficulty in nature-printing is the correct exposure, and this can be mastered after a few tests. Then any object can be printed with some measure of certainty of obtaining a good result.

The world around us offers an endless variety of suitable subjects, small insects and butterfly wings can be reproduced with a wealth of detail, the delicate tracery of crystals recorded, and a thousand and one subjects nature-printed.

(*Continued on page 285*)

The Constructor

Making A Fireplace Suite

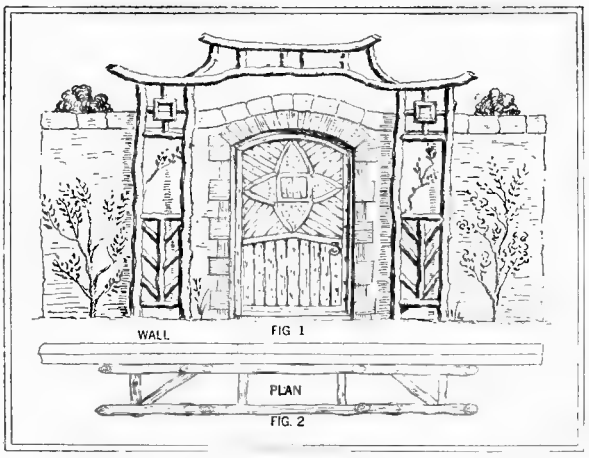


Details for the home-made fireplace suite are given above.

THE fireplace suite which is illustrated above has been designed for construction in oak. It is provided with an artistic surround and firebrick back. The hearth is raised so that a curb is not absolutely necessary but can, of course, be provided by the builder. The construction should be clear from the scale drawings and working details, while the general effect is illustrated in the perspective sketch. Wood mantelpieces should be constructed of properly seasoned timber. The panels should be stained and if necessary, polished before assembly. The back should be painted before fixing, which should not take place before the walls of the building are dry. The overall size of the fireplace moulding is about one inch wider and one-half inch higher than the net size of the wood opening. The wood-work may be finished with wax.—*I. J. Lovett.*

A RUSTIC ARCH AND DOOR

THE illustration shows a design of a rustic arch with an overlay of rustic wood for improving the appearance of a garden doorway. The dimensions will be governed by the individual requirements. They may, however, be kept in similar proportion with regard to height and width. For durability, elm or oak is the best kind of wood to use. This wood is sometimes rather irregular, but this feature can be utilized when curved pieces are required. The posts are about 5 in. in diameter and 9 in. higher than the top of the wall. About 1½ ft. should be allowed for projecting underground and to prevent premature decay their ends should be charred over a fire and coated with tar or a creosote preparation. The arch may be either double or single, with the latter there is less stability.



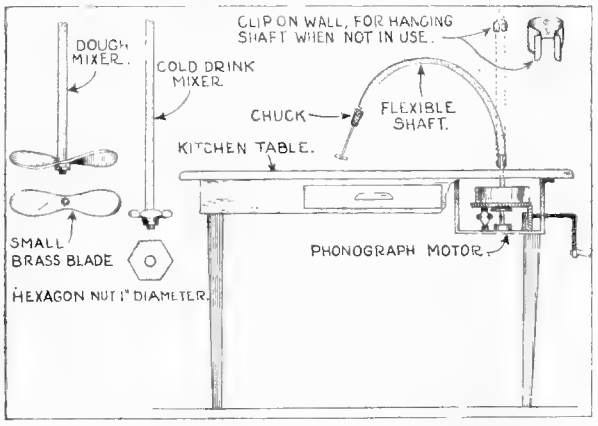
Above, Fig. 1 shows the completed arch and door and Fig. 2 gives a plan view.

The attractive overlay of rustic wood on the door is made of wood which has been cut lengthwise or halved. The bark should be removed so that the work may be varnished when complete. Ten suitably curved pieces are required for the upper panel; otherwise the remainder of the lengths used should be as straight as possible. Cork bark is employed for filling the center portion of the upper panel, and avoids the monotony of too many strips of rustic sections. The panels between the pair of posts next to the wall can be omitted if desired, or can be varied in pattern. No special joints are necessary beyond the hollowing of the ends of pieces that abut on a circular surface, as for instance, between rails and posts.—*I. J. Lovett.*

How to make it

ARTICLES OF INTEREST TO EVERYONE

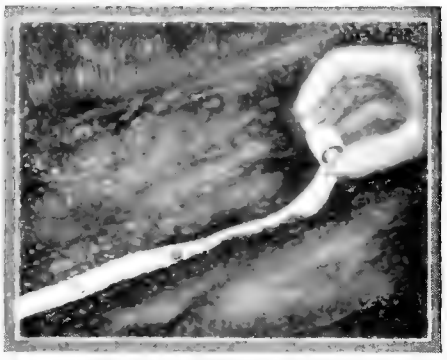
MECHANICAL MIXER



Details of the mechanical mixer for the kitchen are given above. An old phonograph motor is used to supply the power.

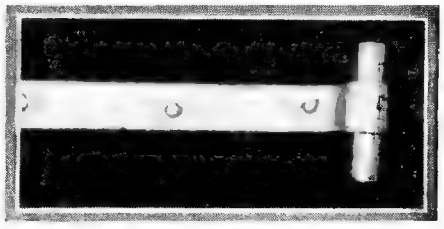
A USEFUL kitchen mixer is shown at the left. A phonograph motor fastened to the kitchen table with the crank-handle extended as shown, provides the rotary motion. A short length of flexible shafting is fastened to the motor and protrudes through the top of the table. At the other end of the shafting a small chuck is attached, so that various mixing tools may be fastened to the shaft. Mixing tools can be made from brass rods as illustrated. When not in use, the flexible shaft is hung on the wall by means of a small clip. The mixing tools being detachable are easily cleaned with hot water.—*Herman R. Wallin.*

SEED TAPES



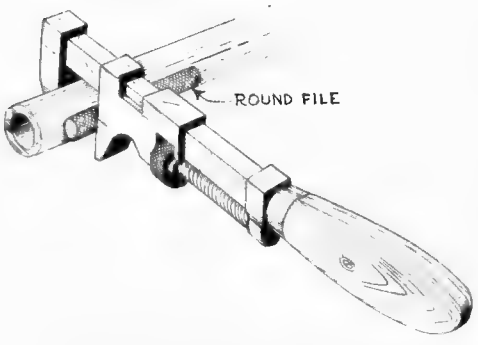
A trench is dug in the ground and the tape unrolled in the manner shown here.

Bulb growers in Holland have adapted a system of sowing the seeds of plants on tapes. Seeds are glued at regular intervals on a paper strip. The seeds are thus rapidly sown at equal distances and at a regular depth. The paper tape soon rots away and in no way interferes with the growing of the seedling. During winter months the amateur gardener can make these seed tapes for spring planting.—*S. Leonard Bastin.*



Above is a photograph of one of the seed tapes with a small wooden roller used for unrolling.

PIPE WRENCH



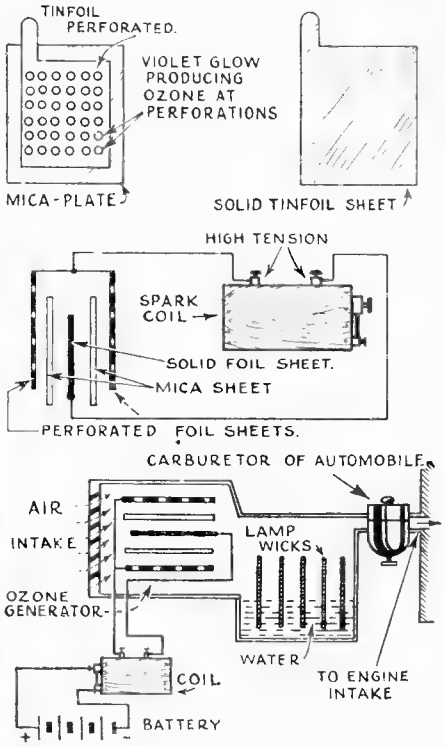
A monkey-wrench and a round file make a good pipe wrench. The jaws must be loose enough to let the file roll up into place when pressure is applied.—Edward Waldo.

PARALLEL MEASUREMENT CALIPERS

Calipers made with a V-leg, as shown, facilitate measuring the distances between bars or shafts and determining whether they are parallel. One can easily tell when both legs are touching the extreme diameters.—H. Moore.

OZONE GENERATOR

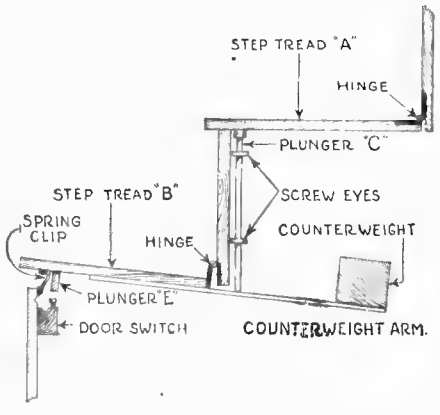
AN improved ozone generator is made from a series of mica and foil sheets connected to a spark coil as shown. The two outer tinfoil sheets, which are perforated, produce the ozone. A device of this nature



Details an ddiagram of connections for the ozone generator appear in the above drawing.

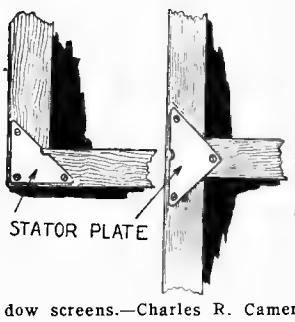
can be used on an automobile to provide better carburetion. A tank fitted with lamp wicks insures a supply of moisture. A solid tinfoil sheet is placed between two sheets of mica and then two perforated sheets of tinfoil attached to mica plates are placed outside of these as illustrated.—*H. J. McPartland.*

TREAD SWITCH



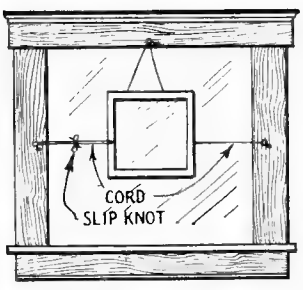
An automatic tread switch is illustrated above and can be easily installed on the attic or cellar stairs. Two successive stair treads are hinged on the risers. The lower tread is counterbalanced and a plunger rod placed at the front part of the upper tread bears against the counterbalance arm as shown. At the front edge of the lower step tread is placed a door switch.—Edwin C. Schroeter.

HOME-MADE BRACES



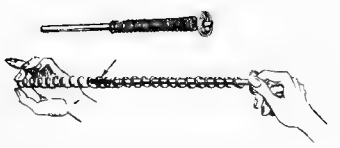
Old variable condenser plates can be used for corner plates and braces when cut to the shape shown at the left. If placed on both sides of a wooden frame, they give a neat appearance to the work, and at the same time are serviceable. These braces can be used to good advantage on home-made window screens.—Charles R. Cameron.

ADJUSTABLE MIRROR



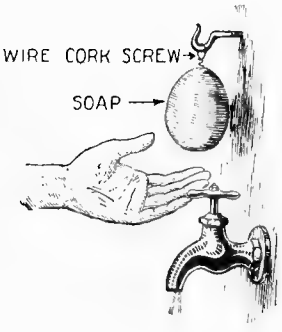
A small mirror can be made adjustable by using a loop cord fastened to either side of the frame, one end passing in back of the mirror. One of the loops is provided with a slip knot, as shown. When not in use the loop may be detached from the mirror and allowed to hang behind the curtains.—C. E. Rectanus.

SPRING "SHOOTER"



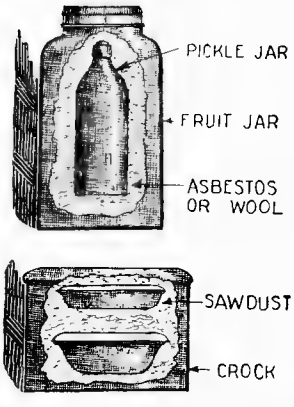
A toy shooter can be made from an old roller spring. The roller is broken and the spring removed and used just as it is for shooting small objects. The illustration shows how it is used.—Albert Wegener.

SOAP HANGER



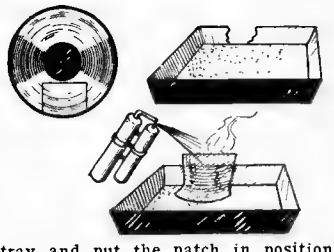
A handy way to keep soap is to hang it up by means of a wire cork screw. This kink is useful where a soap dish is impractical or in the way. A piece of wire is always available and may be fashioned in the required form.—J. H. Byers.

EMERGENCY THERMOS BOTTLE



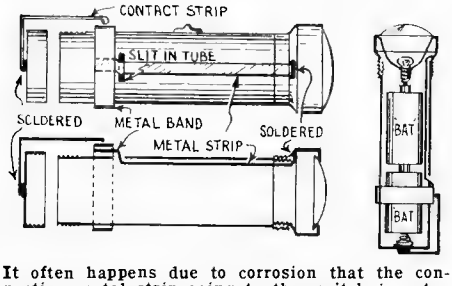
In order to keep food or drink warm over a period of time, the method illustrated above may be employed. The jar containing the food is placed within a large container with sawdust or asbestos paper packed around it.—J. G. Villepigue.

REPAIRING PHOTOGRAPHIC TRAYS



Broken photographic trays may be repaired with a piece of phonograph record. By means of a small torch, heat the patch until it will work easily. Now heat the tray and put the patch in position, pressing it firmly. By means of the torch, the work may be kept pliable and the joint smoothed. The patch should extend over the upper part of the tray so that it may be bent down on the outside, making a pressed joint.—T. F. Maher.

REPAIRING FLASHLIGHTS

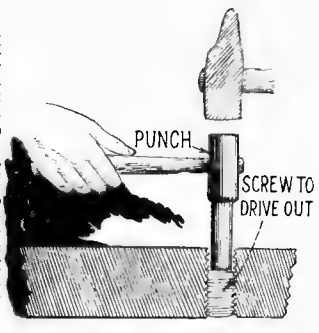


It often happens due to corrosion that the connecting metal strip going to the switch is eaten away, or through some other cause the switch becomes inoperative. If this happens, the switch can be repaired in the manner shown above. The contact is broken as soon as the pressure of the finger is removed from the metal strip.—T. F. Maher.

SCREW CONTAINER

An old muffin pan makes an admirable container for screws, nuts, washers, binding posts, nails, tacks, and the like. Around the workshop it will be useful in keeping these small parts separated and at hand always.—Peter D. Adams.

REMOVING SCREWS

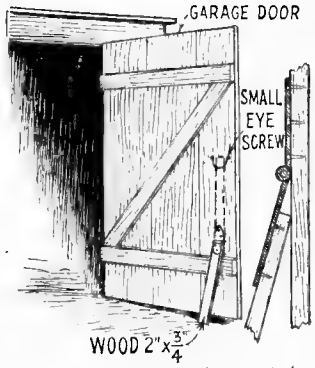


Screws may be removed by employing a cylindrical-ended punch with a flat point. This should be struck with a sledge hammer, and if properly done, the threads will be stripped from the screw, leaving the hole in good condition.—V. A. Lyman.

CALL BELL

An old acetylene or oxygen cylinder tank makes a fine call bell at camp or on the farm. On clear days its note can be heard for a mile.—H. R. Wallin.

DOOR DROP



A very handy prop for keeping garage and cellar doors opened is illustrated here. The prop is hinged to the door and if the door has no back stop one can be fastened to either side. The hinge will have to be bent as shown above. The prop should extend about six inches below the bottom of the door. When not in use it is held up by a wire loop.—A. J. Wolke.

Readers Forum

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them, whether caustic or not. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words or less, and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

RAYING THE BLOOD

Editor, SCIENCE AND INVENTION:

For quite a number of years it has, of course, been possible to transfuse blood from one individual to another, providing the blood characteristics of the donor and recipient were compatible. It seems only reasonable to suppose that we could go a step further by sidetracking the blood of an individual and returning the blood directly back to the circulatory system of that same individual. In doing so, it would very likely be advantageous to interpose a small, dilated quartz tube, which could be rayed with ultra-violet and other rays as the blood is passing through it. But at least two difficulties arise, such as keeping out the air and keeping the blood from clotting; theoretically, if the tube was primed with saline solution, containing some anti-coagulating substance, and if the inside of the tube were thinly oiled or waxed, the experiment should be a success, providing the oiling or waxing did not interfere with the passage of the rays through the blood stream.

Experiments on dogs, and possibly, on other animals, would, of course, have to be done and the blood examined before and afterwards, as to the quality and quantity of its known constituents. Two intravenous needles or canulas could be inserted into a vein and the tourniquet applied first above the needles, and when the tube is in readiness, the tourniquet could be placed between these so that the circulation would be side-tracked, so to speak.

As ultra-violet rays are known to be bactericidal, vitamin-producing and so essential to the maintenance of perfect health, and since these rays readily penetrate quartz, but not glass, it seems perfectly reasonable to suppose that their direct use as a therapeutic measure would be quite beneficial in treating so called "Diseases of the Blood" and, possibly, other diseases as well, especially those diseases known or suspected to be caused by mild infections; it seems possible that some or all of the true anemias are caused by mildly infectious micro-organisms. On the other hand, if the rays were applied with much strength, the amoebic-like, white blood corpuscles might be destroyed or weakened to an alarming degree. Ultra-violet rays may not destroy pathogenic micro-organisms, but this proposed treatment may weaken them sufficiently directly or indirectly so that the white blood cells and other defences of the body may be enabled to restore the body processes back to normal. Also, if the use of these rays actually destroys bacteria in the blood, it may not be judicious to administer prolonged treatments as, when the germs are killed, their toxins may be liberated into the blood stream proper, resulting possibly, in a severe toxemia. Furthermore, some solution could be applied to the tube for ionization treatment.

Because sunlight shows in the spectrum characteristic light and dark lines, indicative of elements, known to this earth, the sun's rays may prove to be ideal for the direct treatment of some diseases, which are in evidence by abnormal findings in the blood. But the solar treatment must be tried out only in highly elevated parts of the country, since it is known that the atmosphere of a city especially, due to its density, smoke and other impurities, is practically impenetrable to ultra violet and, possibly, to other known and unknown rays. Also, it is well to bear in mind the statement that under ordinary circumstances, in the open, ordinary bacteria are all dead in less than twelve hours.

Submitting this vitally important inquiry for discussion in the Readers Forum Department of your intensely interesting magazine, I remain,

W. J. WHITE,
Detroit, Mich.

(There would be less difficulty doing what you suggest than there would be in conducting a blood transfusion operation.

In September, 1921, the editors of SCIENCE AND INVENTION carried on several experiments in the purifying of blood, after removing it from the body and treating it electrically and chemically. The results which we obtained were promising enough to warrant further experimentation. To the best of our knowledge, nothing further has been done along this line, although our own experiments were given wide publicity at the time. Not only did we suggest the use of ultra-violet rays, and special quartz chambers for killing bacilli, but included in the suggestions chambers divided by animal membrane for the removal of urea through osmotic action; the administration of food and the addition of anti-toxins, serums, and antigens. Experiments were conducted on animals.

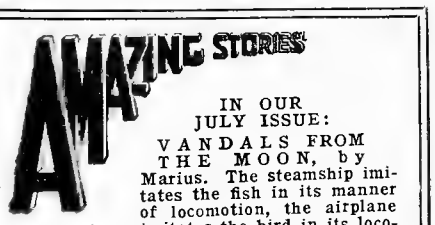
Quoting from the article we find the following: "There are several different arrangements which can be used, particularly owing to the fact that the dosage of ultra-violet rays here produced by mercury vapor lamps, fitted with quartz tubes), cannot be made very strong, as these and X-rays have an untoward effect on the corpuscles of the body; the ultra-violet on the white corpuscles, and the X-rays on the red cells. . . ."

We are glad, however, to once more bring this very interesting and fascinating subject into the discussion.—EDITOR.)

THE RESTORO

Editor, SCIENCE AND INVENTION:

I am a reader of your SCIENCE AND INVENTION, which I consider the best magazine of its type published. I have been following up your articles on the Ionaco and other frauds.



IN OUR JULY ISSUE:

VANDALS FROM THE MOON, by Marius. The steamship imitates the fish in its manner of locomotion, the airplane imitates the bird in its locomotion through the air. But no engineer seems to have ever thought of duplicating the snake motion for propelling heavy bodies. Yet it is perfectly plausible, and the author of this story may prove to be a prophet some day. It is certainly an interesting and original idea and furnishes excellent material in a unique interplanetary tale, this time dealing with the moon people who visit our planet.

THE INVISIBLE MAN, By H. G. Wells. (A Serial in Two Parts) Part II. In the concluding chapters of this story, the harassed and harassing invisible man finally reaches an old scientist friend of his, to whom he relates his experiments, his unexpected success and his subsequent experiences. But you don't need to be a dyed-in-the-wool scientist to become thoroughly absorbed in this detail or in the story of their subsequent experiences. You will enjoy it no matter how much science you know or don't know.

BARON MÜNCHHAUSEN'S SCIENTIFIC ADVENTURES, by Hugo Gernsback. (The three parts in this issue conclude this series.) What will our descendants do ages from now, when their air supply dwindles down to nothing? According to our very remarkable friend, the Baron, the Martians have already solved this problem by their marvelous invention of air plants, with which they generate their own air. The Baron tells us also, how the Martian canals were built, and, lest we think them always serious and scientific, we are permitted a glimpse into their lighter moments and learn something of the kinds of amusement in which they indulge.

And others.

There is now one of these penny-catchers, in this small town (population 25,000). This is the "Restoro Health Institute of Indiana." This company also maintains a branch office in Laporte, Ind. (population 15,000).

I hope that the editors of SCIENCE AND INVENTION will do their best to rid our cities of these "horse-collar" peddlers.

NED L. REGLEIN,
Michigan City, Ind.

(The Restoro, a pamphlet of which you enclosed in your communication, is substantially the same as the Ionaco. Its action on the human organism is as powerful as the Ionaco, which you will remember we considered to be negligible.—EDITOR.)

BODY CHEMICAL ELEMENTS

Editor, SCIENCE AND INVENTION:

To close an argument, will you please state the number of chemical elements known to be contained in the human body?

MRS. B. N. HICKETHIER,
Chicago, Ill.

(The elements found in the human body are generally in combined forms. There are traces of bromine, copper and lead. Arsenic is present to the extent of a little more than three one-hundredths of a grain; aluminum, about 15½ grains; manganese, 46¼ grains; silicon, 46¼ grains; iron, 77 grains; magnesium, 1¾ ounces; potassium nitrate, 2¾ ounces; sulphur, 3½ ounces; fluorine, 3½ ounces; sodium chloride, 8¾ ounces; phosphorus, 28¼ ounces; calcium carbonate, 3½ pounds; ammonia, 4¼ quarts; carbon, 44 pounds, and water, 84 pounds.

The approximately exact quantities of these various substances in a man weighing 200 pounds can be found in the September, 1922, issue of this magazine.—EDITOR.)

ETHER AND REALITY

Editor, SCIENCE AND INVENTION:

With Sir Oliver Lodge as a guide, I recently made a trip through "Ether and Reality."

What a lot he had to tell about ether!

It is the connecting link of the material and the spiritual worlds (VII);

A substance with ascertainable physical properties (VIII);

Absolutely cold (5);

Other than matter (5);

Its pressure is probably a million times greater than that of the atmosphere (28);

It conveys light (41);

It is the vehicle of gravitation and cohesion (44);

It has an electric property corresponding to elasticity and a negative property corresponding to density (57);

It is incompressible; the densest substance known (98);

Among its functions are gravitation, cohesion, light, radiation, electricity, magnetism (137);

Its first function is to weld atoms together by cohesion (154);

Its second function is to transmit vibrations from one piece of matter to another (154).

Now wouldn't that jar you? These properties and some others developed elsewhere suggest this concise summary: Ether is perfectly dense, perfectly rigid, perfectly elastic, perfectly continuous, perfectly weightless, perfectly frictionless and—perfectly ridiculous.

Although Newcomb died in 1909, long ere Sir Oliver's explanation of the mysteries, yet enough of it drifted about in Newcomb's day to make the judicious grieve. Is that why Simon put the quotes around *"aether?"*

In order to make way for "quanta," I have read that Planck had to deny the continuity of the "ether," and J. J. Thomson came to the same result from electro-magnetic phenomena. Berthoud declares Fresnel's ether had to be equipped with properties so contradictory as to make it a physical monstrosity. According to Maxwell and the Einsteiners, it is something else again. Steinmetz said that electro-dynamics developed without needing the hypothetical ether.

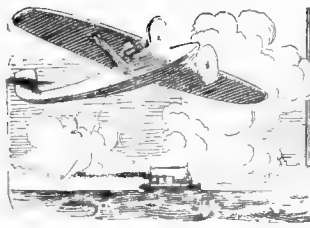
I throw a ball to you. There isn't any medium required to transmit it. Despite Sir Oliver's claims, does gravity require any medium to transmit it? The rushing electric current has momentum and overshoots the mark, he says. Evidently then that does not require a medium to transmit it.

The sun, the earth, other planets and their satellites rush along at miles per second through space, space that Sir Oliver says is filled by ether, the densest substance known. And yet, and yet—not only are we unable to detect any friction, but that "densest substance known" does not even strip off the light, gaseous atmosphere of the earth!

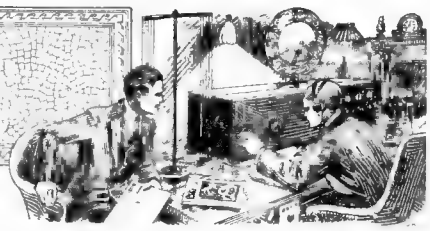
In describing ether as a transmitter of force, Lodge is much concerned to show the impossibility of contact. So he has the ether transmit the energy from one body to another. Fire a projectile into a steel plate. Heat appears. Say it is due to contact of the projectile or the projectile particles with the plate or the plate-particles. Now is it any simpler or more intelligible to insert, as Lodge does, a hypothetical ether to convey or transmit the energy from one to the other? His explanation, it seems to me, is decidely worse than the condition to be explained.

Here's a gem. "Sound waves travel in water four times as quickly as in air. But in the ether waves travel a million times as quickly: hence the ratio of elasticity to density in the ether must be enormous." See page 52.

(*Continued on page 265*)



Radio



Radio Story of the "Bremen"

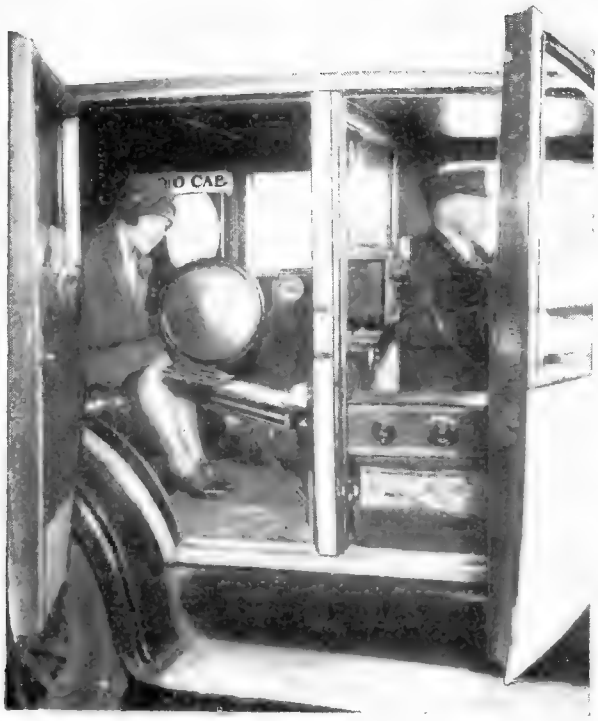
The photo above shows the "Bremen" before taking off, just after it had landed from a test flight at Baldonnel Field in Ireland. The plane is of all-metal construction and was built in Germany by the Junkers Airplane Corp. This monoplane carried the three aviators on the first east-to-west flight, from Ireland to Greenely Island, where they were forced down by sleet, heavy winds and lack of fuel.

At the right is a photo of Stuart Davis, of Manchester, New Hampshire, who was the first in the United States to pick up the message of the "Bremen's" safe landing.

At the left is the lighthouse and radio station at Point Armour, which was the first to flash the news that the "Bremen" fliers were safe. A message of the fliers' arrival was carried from Greenely Island to this point, a distance approximately 15 miles.

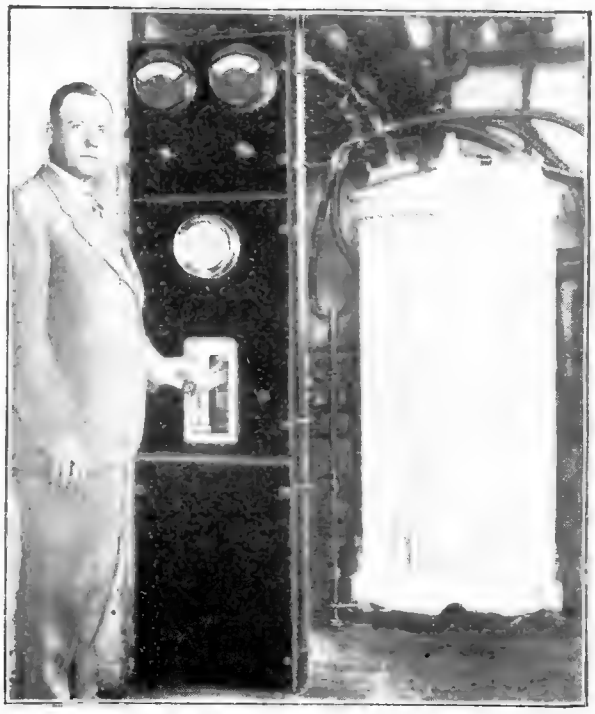
The photos above depict what may be called the radio story of the "Bremen" flight. The station at Point Armour was the first to send out the message on the eventful day of the plane's arrival. In the circle is Stuart Davis, who owns and operates a radio station at Manchester, New Hampshire. He was the first to receive the message from Point Armour, and flashed it out again to an anxiously waiting world. Although the Bremen was equipped with every possible aid to navigation, no radio equipment was taken on the flight. A great object was to save weight.

A Radio Taxi



At the left is a photograph of a radio taxicab used in Caldwell, New Jersey. The radio set and batteries have been installed in the front seat, next to the driver. A loud speaker of the cone type is placed in the passenger compartment, thus providing entertainment for the patrons. The musical cab has been a great success. Another taxicab company in Maplewood, New Jersey, is also equipping their cars with radio sets.

Sleet Remover



The picture at the right shows the new equipment used during the past winter at the Arlington Radio Station, to prevent the formation of sleet and ice on the antenna. By means of the transformer seen in the background, a current of about 800 amperes is sent through the antenna, converting it into a huge heating element, melting the ice.

Fireboats Directed By Radio

Alarms and Orders Now Sent and Received Via the Air

"The S.S. President Roosevelt," which went to the rescue of the foundered British freighter "Antinoe," returned to New York harbor and was given a noisy and enthusiastic greeting. While the ship was in port, the captain and men who manned the life boats received honors. Many fire boats and ships turned out to welcome the heroes. The "John Purroy Mitchel" participated in the welcome. This fireboat is shown at the right with her many streams of water spraying into the air. The "J. P. Mitchel" is equipped with the latest fire-fighting apparatus, including a complete radio installation for receiving orders and fire alarms. The New York Fire Department is testing out the radio equipped fireboats and the New York Harbor fire fighting forces will now be controlled by radio. The photographs appearing here show a number of views of the equipment used at the present time with the fireboats.

Below is a photograph of the "fighting top" of the New York fireboat "John Purroy Mitchel," showing part of the radio antenna system. Orders from ashore are picked up by this antenna and are sent to it from the microphone of a radio fire alarm box which is shown in the other illustrations appearing here. This box also sends out the fire alarms.

The radio installation has already proved its worth and the complete New York Harbor fire-fighting forces are soon to be controlled by radio. To send a signal it is merely necessary to pull down a lever placed on the front of the radio fire-alarm box. This simple operation immediately sends out the fire alarm, as well as placing a microphone in a position for use when giving additional directions.

The photograph at the left shows a view of one corner of the radio installation on the "John Purroy Mitchel" of New York. A radio operator will stay at his post to receive orders from the shore while the boat is fighting harbor blazes. Firemen on the shore are able to grasp the situation easier than those upon the immediate scene of the conflagration and can thus send valuable directions to the "fighters."

Above we see how the new radio fire alarm box is opened immediately by simply pulling a lever downward. This operation automatically sends a fire alarm and, at the same time, places the microphone in a position for use. Thus, the alarm is sounded and the position of the fire is sent to all fireboats within the vicinity in a few moments' time.

The picture at the left shows an interior view of the radio fire alarm box. Once the door of the box has been opened and the alarm so sounded, the microphone can be used for communication from the land to the fireboats engaged in fighting the fire. The microphone is of the type which is used in all present day radio broadcasting stations. Part of the alarm system may be seen attached to the rear of the front door of the fire box.

The alarm and microphone are housed within a metal box, which is painted in the conventional red color.

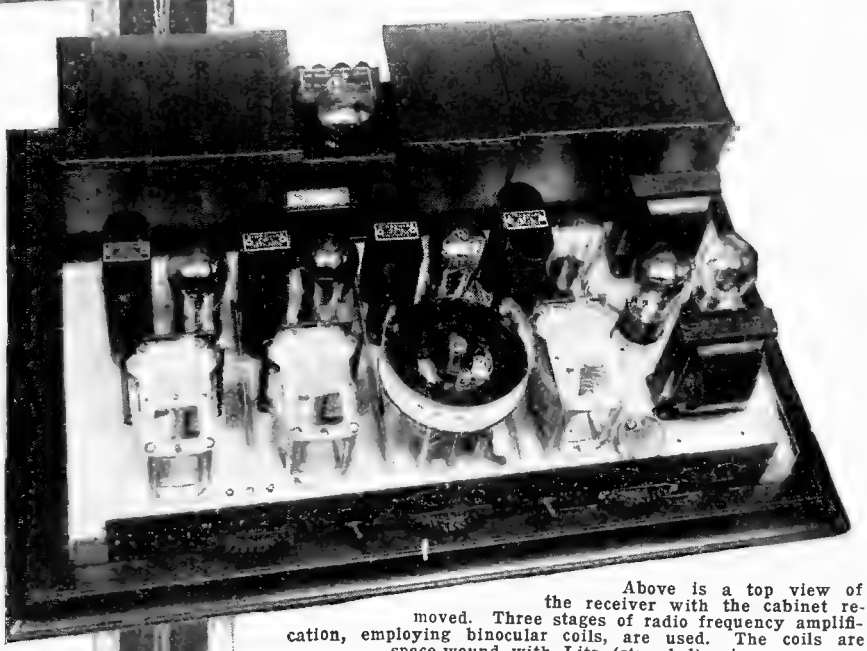
A New Electric Set

"Local-Distance" Switch and Single Control Are Outstanding Features

Below is a front view of the receiver, showing the neat arrangement of controls and artistic finish of the front panel.

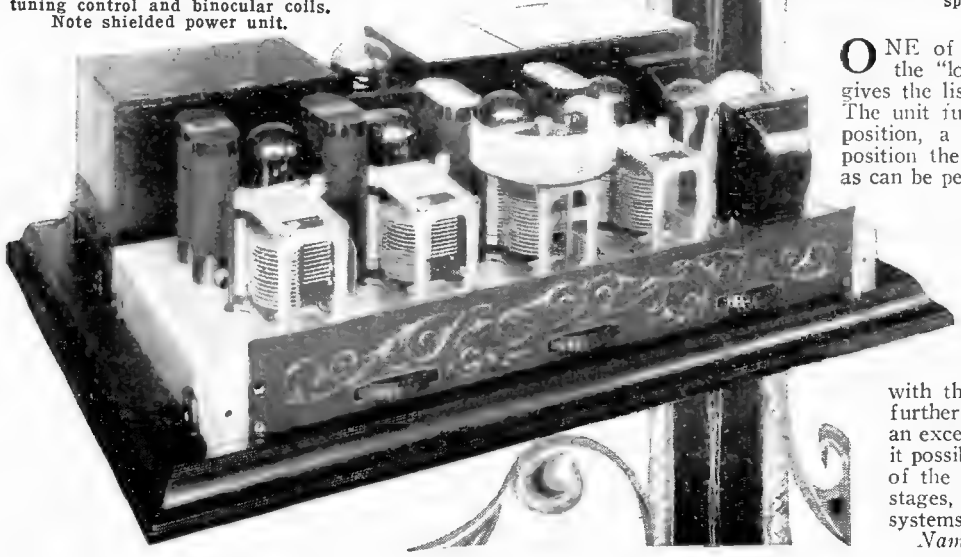
A NEW all electric set of advanced design, embodying many unique radio developments, has recently been made available to the public by one of the pioneer set manufacturers in the east. The new A.C. six consists of four major units, the receiver itself, power unit, chassis and cabinet. Three stages of radio frequency amplification employing binocular coils, space-wound with Litz wire, are used. A type 171-A power tube is placed in the last audio stage. Four straight line frequency condensers are used for tuning. Filament, plate and grid voltages are supplied by the power unit. The tubes supplied are: three radio frequency tubes of the 226 type, detector tube of the 227 type, the A.C. tube in the first audio stage and a 171-A in the last audio. For rectification a type 280 tube is employed. The operating cost of the power unit is very low, being only one-half cent per hour when the rate is ten cents a kilowatt hour. The two power transformers are impregnated with a special compound to eliminate any mechanical hum. All connections between the power unit and the set are made with a colored cable.

THE new all-electric set of advanced design, of heavy aluminum with four reinforcing ribs which add to its rigidity. The mounting frame forms the base of the cabinet and is finished to match the cabinet. Mahogany veneer is used for the body of the cabinet, while the front panel is of stump walnut, artistically finished in attractive design. This may be seen in the photo at the left. Two sections of the panel are cut out to allow for an oblong inlaid bronze-metal control board on which are mounted the tuning control, antenna compensator, volume control and switches. Above this may be viewed an illuminated drum, graduated in kilocycles. A sharply tapered type of variable resistance shunted across the primary of the R.F. input transformer gives a smooth, gradual control of the input, affecting the intensity of the output. Since it controls the R.F. input to the detector tube, there is no chance of the detector tube overloading.



Above is a top view of the receiver with the cabinet removed. Three stages of radio frequency amplification, employing binocular coils, are used. The coils are space-wound with Litz (stranded) wire.

Below is a front view showing tuning control and binocular coils. Note shielded power unit.



ONE of the outstanding features of the receiver is the "local-distance" switch. This ingenious device gives the listener exceedingly flexible control of the set. The unit functions so as to obtain, when in the "local" position, a wider frequency band. In the "distance" position the selectivity of the receiver becomes as high as can be permitted without cutting off side bands. Here the set becomes very sensitive and selective, enabling the reception of distant stations with a minimum of local interference. It it interesting to note that all controls are of the horizontal type and operate from left to right and vice-versa. To provide for matching various sizes of antennas to the set, a variable inductance coil has been included in the circuit. Once set, with the average antenna and ground, it needs no further adjustment. However, if a long aerial or an exceptionally short one is used, this control makes it possible to compensate the inductance and capacity of the first stage with those of the succeeding R.F. stages, allowing for a wide variation of antenna systems.

Name of manufacturer furnished upon request

SECRET RADIO TELEPHONY

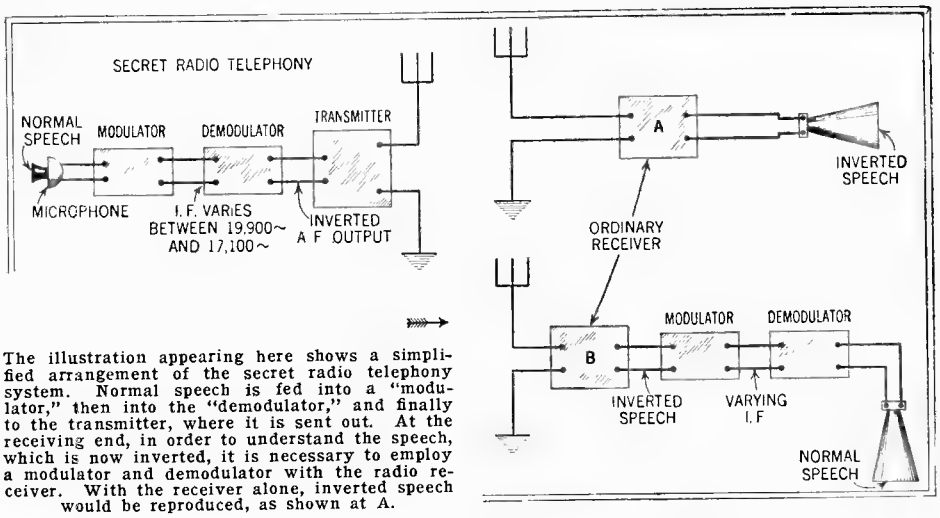
Synthetic Languages Made Electrically, Provide Secrecy in Communication

Photo Courtesy Bell Telephone Laboratories.

The above photo shows Mr. S. P. Grace and L. W. Davee demonstrating the method of using the speech inversion apparatus. On the table may be seen the modulator and demodulator.

TRANS-ATLANTIC radio telephony is now finding a steady and increasing use, and the service will probably be extended within the next year. Already the daily period has been extended from 4½ hours to 10½ hours. The first year's experiment may be taken as a prophecy that telephoning between America and Europe will soon become as commonplace as telephoning throughout this country. From January 7th, the first day of service, to December 20th, there were 2,173 calls, nine-tenths of which were completed. It will readily be seen that this means of communication is on the increase, but there is one factor which undoubtedly prevented many from adopting it. The radio eavesdropper who owned a receiver capable of tuning to high wavelengths could easily listen in on all conversations, perhaps using the knowledge he received.

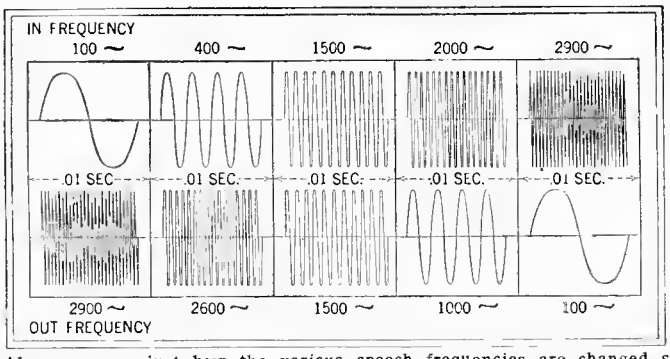
However, thanks to the Bell Telephone Labs., a method of protecting conversation from outside ears has been perfected, and there is little question that it will be installed in the near future on all radio telephones now used commercially for paid calls. To accomplish this, a special apparatus has been devised which inverts normal speech, so that for every frequency a new one is produced, whose frequency is equal to some selected constant frequency, minus the original frequency. The result is an unintelligible series of discordant sounds. By using the inverting apparatus, English spoken before a microphone may be reproduced on a loud speaker as a succession of sounds which apparently have no relation to the original normal speech. These new sounds, however, may again be converted into English by passing them through an "electrical translator," which is further described herewith.



The illustration appearing here shows a simplified arrangement of the secret radio telephony system. Normal speech is fed into a "modulator," then into the "demodulator," and finally to the transmitter, where it is sent out. At the receiving end, in order to understand the speech, which is now inverted, it is necessary to employ a modulator and demodulator with the radio receiver. With the receiver alone, inverted speech would be reproduced, as shown at A.

HOW THE WORDS ARE SCRAMBLED

SOMEWHAT briefly, the apparatus works as follows: Normal speech coming from the microphone is fed into a modulating apparatus where the inverting or modulating frequency acts similar to a lens when it inverts the image of an object; causing the top to appear at the bottom, and the bottom at the top. The apparatus now developed uses 3,000 cycles as the inverting point although there are frequency components in ordinary speech above this value, they are eliminated by filters. Before the speech passes into the inverting apparatus, it must go through the filter, but this does not affect the quality to any great extent. Thus, the speech range is kept within a band extending from 100 to 2,900 cycles. With the 3,000-cycle inverting apparatus, the resulting speech also occupies this band, but in reverse order, as shown in the illustration. The voice of a person talking in low tones is delivered from the apparatus as a high-pitched sound, with a lower grunt occasionally, due to overtones in the original speech frequency. Thus as an example, Mr. S. P. Grace showed that the words Illinois Telephone Association issued from the inverting apparatus in something that sounded like "Oyaneon Playafiend Acecilofin."

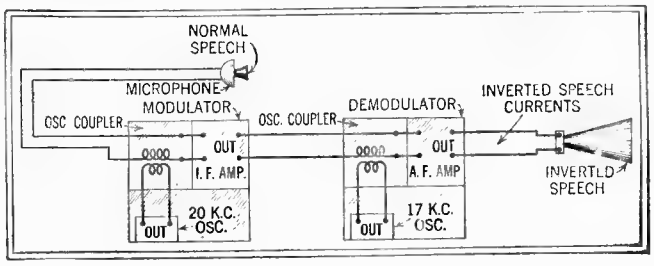


Above we see just how the various speech frequencies are changed so that an incoming frequency of 100 cycles is changed to one of 2,900 cycles, and the 2,900-cycle sound is changed or inverted to one of 100 cycles per second. It is interesting to note that the 1,500-cycle frequency enters and leaves the apparatus at the same value.

This process can be reversed, the "inverted" speech may be imitated before a microphone and translated back into English. In the inverting process there is practically no loss of quality, as was demonstrated when phonograph records of inverted speech were played near the microphone and reinverted to normal speech.

APPARATUS USED.

IN the actual apparatus used today, two modulating steps are employed, one at 20 and the other at 17 kilocycles. This gives the same result that would be obtained from a single modulation at 3 kilocycles. In the process of modulating certain distorting frequency components are introduced which are difficult to filter out when the modulating and modulated frequencies are closely alike. This would be the case when a speech band of from 1 to 2,900 cycles modulated a 3,000-cycle frequency. By allowing the speech or voice band to first modulate a 20-kilocycle frequency, the distorting frequencies are eliminated. This results in an upper and lower side band, the upper one being filtered out and the lower then modulated by a 17-kilocycle frequency. This again gives two side bands, of which the upper is filtered, leaving the lower band. This band is in the same range (*Continued on page* 259)

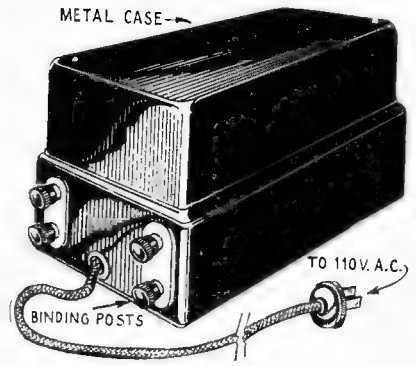


At the right we have an illustration showing in simplified manner the operation of the modulator and demodulator and how they are connected to the microphone. The modulator makes use of a 20-kilocycle oscillator, and the demodulator a 17-kilocycle oscillator. For the sake of simplicity speech filters have been omitted.

NEW RADIO DEVICES

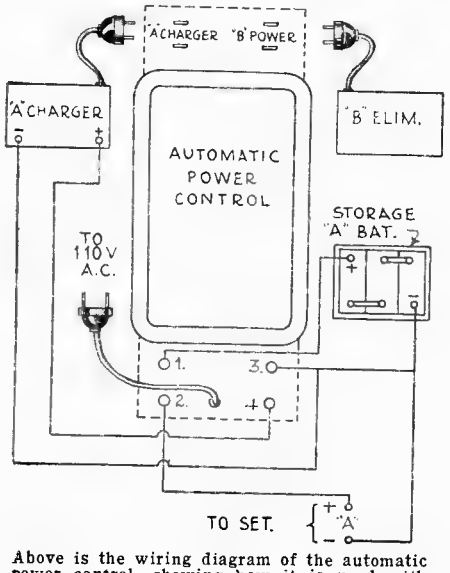
Accessories Recently Developed Which Will Be of Value with Any Radio Set

AUTOMATIC RELAY



A view of the automatic relay appears above. This unit is housed in a black metal case with four binding posts on the front and two sockets on the back, for plugging in the "A" battery charger and the "B" eliminator.

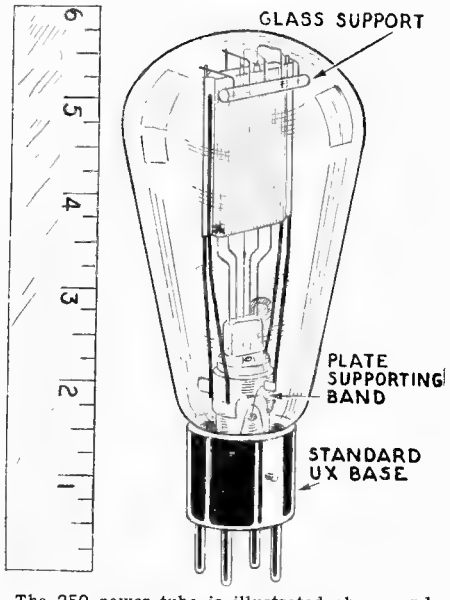
AN automatic power control or relay has recently been developed by a prominent Chicago radio manufacturer. This power control automatically cuts out the charger and automatically cuts in the "B" eliminator when the filaments of the tubes in the set are turned on. When the set is turned off, the "B" eleminator is cut out and the "A" charger automatically cut in for charging the battery. In addition to doing this, the relay serves a most important function; it is adjusted to cut out the "A" battery charger when the storage battery becomes fully charged. The device can be used with sets having four to seven 201A-type tubes, or the equivalent in current consumption, which is one to one and three-quarter amperes. If more than eight tubes are used, it is only necessary to remove a thin resistance wire connecting two posts directly under the cover and to place a heavy resistance wire in its place. These two sizes of resistance wire are furnished with the relay. If 199-type tubes or less than four 201A-type tubes, or the equivalent in current consumption, are used, the resistance wire connecting the binding posts should be removed. The voltage drop is less than .2 volts on all sets using up to eleven 201A-type tubes. As will be seen from the wiring diagram, the automatic relay is easily installed, the "A" battery charger and "B" elimninator being plugged in as indicated.



Above is the wiring diagram of the automatic power control, showing how it is used with the radio receiver and "A" and "B" power supply.

NEW POWER TUBE

ONE of the largest radio corporations in the country has developed a new power tube larger than any which were available before. The tube is known as the type 250. It is intended for use only as a power amplifier or transmitting tube. The filament rating is 1.25 amperes at 7½ volts, which is the same as that for 210-type tubes. The filament, however, is of the coated-ribbon type, such as that used in the 281-type rectifier. As the filament operates at a dull red heat, the low operating temperature and increased size of the filament results in minimum hum when operated from an A.C. supply. This power tube is of the low-mu type, amplification factor being 3.8. The maximum plate voltage is 450 and the negative grid bias when using this voltage should be 84 volts. The maximum undistorted output is 4,650 milliwatts when using maximum plate voltage. When used as a transmitting tube, the 250 is rated at 25 watts, as compared to the 7½-watt rating of the 210. Following is a table of characteristics for the 250 tube:

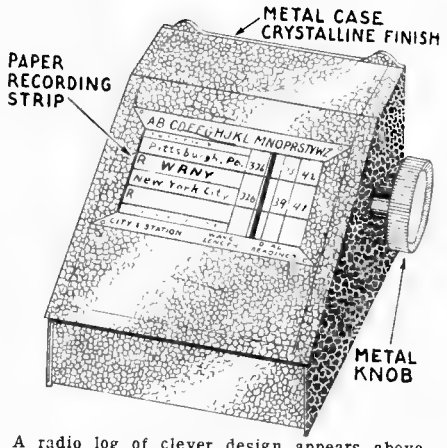


The 250 power tube is illustrated above, and when used as a power amplifier will supply tremendous undistorted output.

Plate Voltage	250	300	350	400	450
Negative Grid Bias Voltage	45	54	63	70	84
Plate Current (milliamperes)	28	35	45	55	55
Plate Resistance (ohms)	2,100	2,000	1,900	1,800	1,800
Voltage Amp. Factor	3.8	3.8	3.8	3.8	3.8
Max. Undistorted Output (milliwatts)	900	1,500	2,350	3,250	4,650

A low resistance output choke with a condenser, or a transformer capable of handling the heavy plate current of the 250 without saturation of the core or overheating, must be provided for this tube, to prevent excessive voltage drop in the plate circuit and to protect loud-speaker windings. The 250 tube is not particularly suited for use in a push-pull output system on account of the extremely high signal voltage which is necessary to operate it at anywhere near its maximum output. If more power is desired than a signal tube is capable of delivering, two of them may be connected in parallel, with the result that the power output is doubled.

RADIO LOG

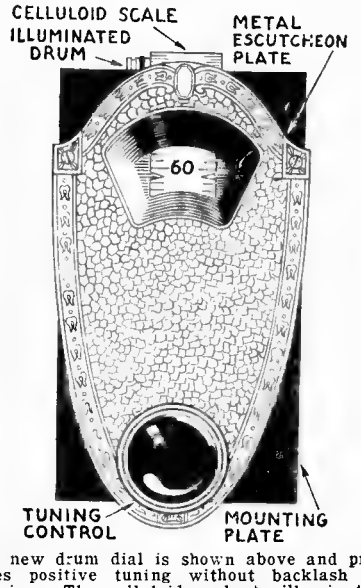


A radio log of clever design appears above. The paper recording strip is turned by means of a metal knob, as shown.

A NEW radio log, made by a New Jersey concern, has recently appeared on the market. This is housed in a metal case having a crystalline finish. Dial readings for all broadcasting stations can be logged in two ways, either alphabetically by cities or by the second letter of the call letters. A red diagonal line in conjunction with the alphabet nameplate furnish a quick indexing feature, enabling the operator to immediately find the station desired. The diagonal line moves across the alphabet plate, pointing to the various letters on the plate which correspond to the letters on the paper recording strip.

DRUM DIAL

A MASSACHUSETTS radio manufacturer is now producing an illuminated drum dial of pleasing design. It is equipped with a metal mounting plate and an antique silver escutcheon plate. The drum is turned by means of a bakelite knob situated near the base of the escutcheon plate, a number of pulleys and a cord being used for the control. Springs attached to the ends of the cord take up any slack and keep it tight at all times. The dial and escutcheon plate mount together, with the panel between.



The new drum dial is shown above and provides positive tuning without backlash or slipping. The celluloid scale is illuminated by a small dial light.

(Names of manufacturers furnished upon request.)

RADIO ORACLE

In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

SCRATCH FILTER

(629) R. Lindsay Wickes, New Haven, Conn., asks:

Q. 1. Will you please give data for constructing a scratch filter to be used with a phonograph pick up.

A. 1. A satisfactory scratch filter consists of a 1,500 turn honeycomb coil connected in series with a .008-mf. condenser. This series combination is placed across the first audio frequency transformer primary, or across the pick up. If a honeycomb coil of this size is not available, 1,800 turns of No. 28 D.C.C. wire may be wound on a form 2 inches in diameter and 1 inch wide, or, an 85 millihenry choke may be used in place of the honeycomb coil.

RADIO DEFINITIONS

(630) J. B. McKnight, San Diego, Calif., asks:

Q. 1. Kindly give me the correct technical definitions of the following radio terms: sensitivity, selectivity and fidelity.

A. 1. The Institute of Radio Engineers has compiled the following definitions: Sensitivity is the degree in which a radio receiving set responds to signals of the frequency to which it is tuned. Selectivity is the degree to which a radio receiving set is capable of differentiating between signals of different wave frequencies. Fidelity is the characteristic of a system or a portion of a system, by virtue of which it accurately reproduces at its output, the modulation of the signal which is impressed upon it. As applied to a radio receiving set, fidelity is measured by the accuracy of reproduction at the output terminals of the modulation of the received wave. The term fidelity is therefore used to describe the faithfulness of the reproduction of a sound.

RECEIVER DIAGRAM

(631) S. Somerset, Buffalo, New York, asks:

Q. 1. Will you kindly publish a diagram of the six tube Argus electric radio receiver of the cabinet type using 199-type tubes and 210 power tube.

A. 1. On this page you will find the hook-up of this electric set. Five 199-tubes are used with a 210 power tube in the last audio stage. For rectification, two half-wave rectifiers of the 281-type are employed. The eliminator which is incorporated in the receiver supplies all the tubes with the necessary A and B power. An electrolytic condenser is used in the eliminator as shown, and a power rheostat placed in series with the primary of the eliminator transformer, controls the input voltage from the line. A small switch is provided within the receiver, so that the audio amplifier may be used with a phonograph pick-up when desired. Volume is controlled by means of a 500,000 variable resistance placed across the first audio transformer secondary. The sensitivity control consists of a 1,000 ohm potentiometer. Provision is made for the use of either a long or short antenna. Generally no antenna is required, the light lines providing sufficient pick-up of energy. If no aerial is used, a wire should be connected from the red binding post to either the long or short antenna posts.

GASEOUS RECTIFIER

(632) I. Kerensky, Carter, So. Dak., writes:

Q. 1. What is the action which takes place in a gaseous rectifier. How is it possible to prevent the current from flowing equally in both directions?

A. 1. When potential is applied to the gaseous rectifier, the gas atoms become ionized. Each atom now positively charged is attracted to the cathode or negative element from which it picks up another electron and returns to its original state, only to be re-ionized by collision with other atoms, and again to pick up an electron from the cathode. The electrons which are lost seek the positive terminal of the tube and hence a flow of electrons occurs from the cathode to anode through the external circuit. If the anode and cathode are of the same dimensions, the current will flow equally well in both directions. However, by making one electrode small in comparison with the other, the positively charged atoms may readily strike one electrode and pick up electrons, while with the potential in the opposite direction their ability to strike the small electrode and secure the necessary electron is greatly diminished. The atoms in their attempt to do this collect around the small electrode and build up a positive charge which tends to repel the other atoms. A few however, do strike the small electrode and cause a back or reverse current to flow. This back current, however, is now reduced to a negligible factor. In the full-wave rectifiers of this type, the two anodes are in the form of pins or points with one large cathode. The two anodes are so constructed that alternately one and then the other passes current, resulting in full wave rectification.

Q. 2. What determines the life of a gaseous rectifier?

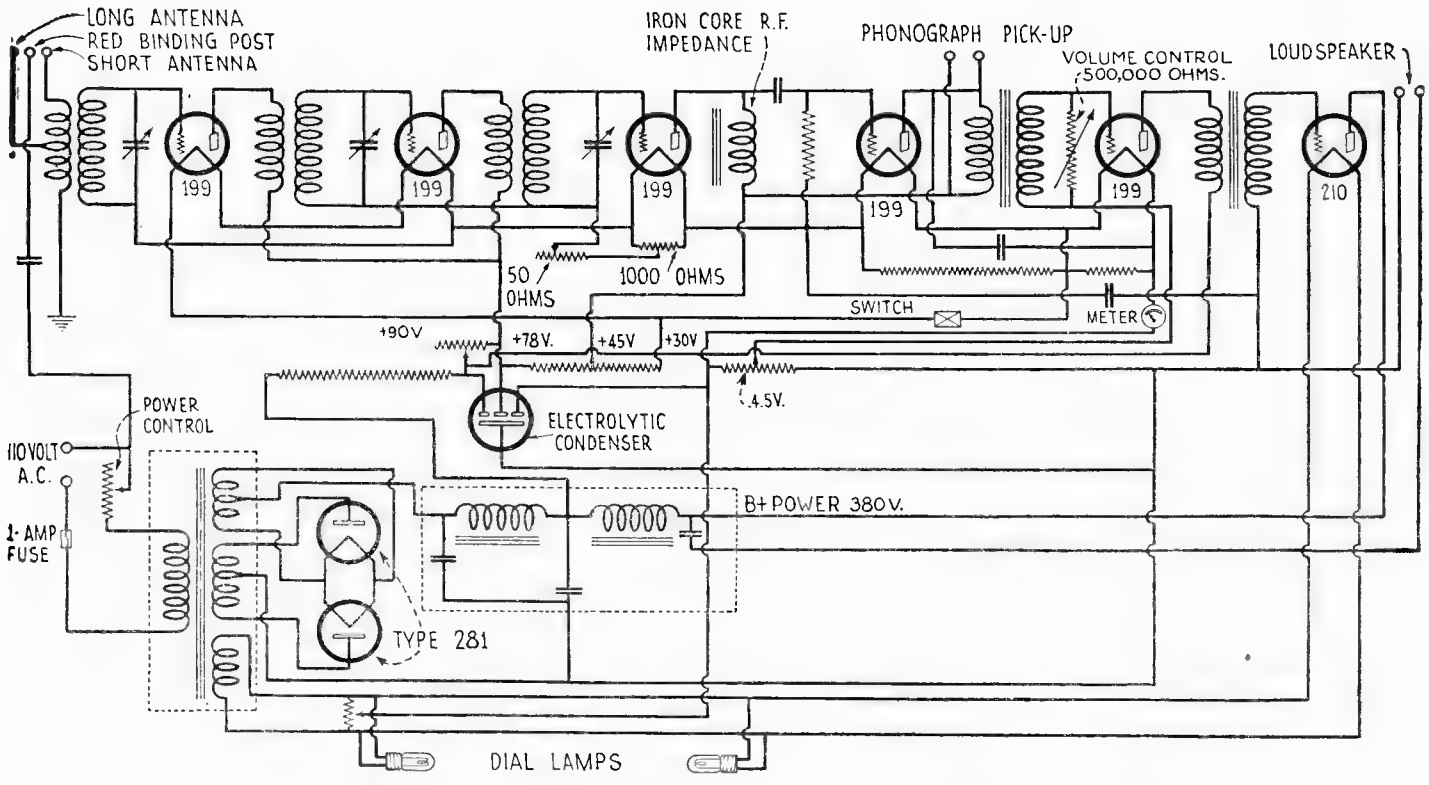
A. 2. The life of a gaseous rectifier depends upon several things. The purity of the gas employed, the amount of gas introduced into the tube or gas pressure, the removal of impurities from the materials of the rectifier, all play an important part in the tube's life. The surface of the electrodes are also guarded against being ripped apart by the bombardment of the gas atoms. The applied voltages and the current passed also help to determine the life of the tube.

GETTING LOW NOTES

(633) L. Grisby, Des Moines, Iowa, writes:

Q. 1. I have a receiver in which three stages of resistance coupling are used and am operating this with a good cone speaker. While the tone quality seems to be good at times a rumble on low notes is heard. There seems to be a resonance point in the output system in the neighborhood of 70 cycles. Will you kindly tell me the simplest was to remedy this nuisance?

A. 1. One of the simplest methods of clearing up this difficulty which is doubtlessly known to many radio fans, is to remove the coupling resistor from the second audio stage. In its place connect an old audio frequency transformer primary or an iron core impedance. This same thing is done in large broadcasting stations where the process of balancing the scale of frequencies is known as "equalization." With outside pick-ups, certain frequencies are transmitted with less fidelity than others, and these are boosted in much the same manner as mentioned here. The average cone speaker in comparison with the average horn usually reproduces low notes better. Resistance coupled amplifiers also favor the low notes, but these amplifiers usually have a distinct cut-off at high frequencies. Your combination is one which favors the low frequencies, very often producing a rattle on low notes. The high notes have been boosted by substituting an iron core impedance in place of the resistance. It is probable that the response curve of the audio amplifier has been leveled out somewhat. Taking out the coupling resistance and substituting a comparatively low inductance choke coil will always increase the amplification of the higher register more than that of the low register.



Above is the circuit diagram of the all-electric receiver which uses five 199-type tubes and one 210 power tube in the last audio stage.

A small switch is provided so that the audio amplifier can be used with a phonograph pick-up. Tip jacks for pick-up are on sub-panel.

Scientific Humor

PROGRESS

SLIM: "How are you getting along with your Physical Culture Exercises?"

SLAM: "I have got so I can touch my knees without bending the floor."

—Leslie Carpenter.

CORE-RECT

BILL: "What did Newton do with the apple that fell on his head?"

BELL: "Wound a wire around it and sent a current of electricity through to see if he could magnetize the core."—*Leslie Carpenter.*

FOR BACK SEAT DRIVERS

AUTO MANUFACTURER: "What's the idea of having the steering wheel in the rear seat on the new models?"

DESIGNER: "That leaves more room up front for the accessories."

—D. L. Cotie.

A FLAT STORY

"Look out for your balloon tires, mister."

"Why, what's the matter?"

"There's a fork in the road ahead."—*Leonard Keiser, Jr., Rep. No. 27,612.*

THAT IS PROGRESS

"Do you think John Hopkins is getting anywhere with his bacteriological experiments?"

"Is he?" Why, he's just discovered a new disease that can be cured by Listerine."—*Gleason Pease.*

ISN'T THAT CORRECT?

SAM: "Why did they arrest Dr. Blank?"

BO: "Oh, he had a patient with a scalp wound, so he put a torniquet around his neck."—*Fred Eastman.*

SHE HAS HIM PANTING

VISITOR: "Sonny, what's the noise upstairs?"

SONNY: "Maw is dragging Paw's pants over the floor."

VISITOR: "That shouldn't make much noise!"

SONNY: "I know, but Paw is in 'em."

—Ed. Simon.

UN-CRANE-Y

FIRST PRIZE $3.00

AMERICAN: "Yes, my brother was killed by a revolving crane."

ENGLISHMAN: "My, what fierce birds you have in America!"

—Fred Kohler, Jr.

WHEN MUSHROOMS ARE EDIBLE

BOTANIST: "Sleep all right?"

WIFE: "Splendidly."

BOTANIST: "Not sick at all—no pains?"

WIFE: "Why, of course not, dear."

BOTANIST: "Hurrah, then, I've discovered another species of mushroom that isn't poisonous."—*Maurice Blank.*

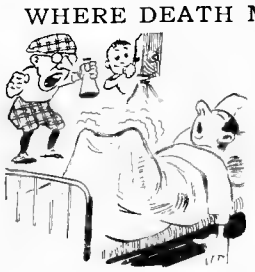
ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

WHERE DEATH MEANS LIFE



It was a deathbed scene, and the director was not satisfied with the hero's acting. "Come on," he cried, "put more life in your dying!"

—Ed. Simon.

ECONOMY FIRST

"Shall I have your lunch brought up to you here on deck, dear?" asked the husband of his seasick wife.

"No, love; have it thrown straight overboard; it will save time and trouble."—*Stanley Stanbery.*

SOME CUT-UP

SOCIETY MOTHER (languidly): "Well, nurse, how is baby today?"

NURSE: "He cut two teeth this morning."

MOTHER (still more languidly): "That was careless of you, nurse! You ought not to let a young baby play with a knife."

SCREEN TITLE

Everyone thought he was nutty in trying to prepare for a rainy day by endeavoring to cross an umbrella with a homing pigeon!

—Henry A. Courtney.

TURN OFF THE WATER

"Gold mining," said the engineering professor, "by hydraulic methods is practically unknown in America at the present day."

"Not by a long shot," said the cynical student. "Have you ever seen a sympathetic chorus girl at work?"

—D. L. Cotie.

BOTH RISE

"When water becomes ice," asked the teacher, "What is the great change that takes place?"

"The greatest change, sir," said the student, "Is the change in price."

—Joseph Baum.

VERY SERIOUS MALADY

"Hey Bill."

"What is it?"

"Your doctor is out here with a flat tire."

"Diagnose the case as flatulency of the perineter and charge him accordingly. That's the way he does business."—*Albert F. Williams.*

NOT A DIRTY TRICK

"What are you crying for, my lad?"

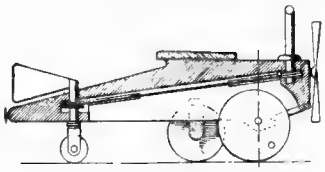
"Father's invented a new soap substitute and every time a customer comes in I get washed as an advertisement."

Fred Kohler, Jr.

SCIENTY SIMON, Scientist

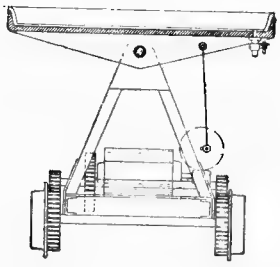
O.K. JOE! - NOW WE'LL TRY THAT LITTLE PHONE EXPERIMENT! - WHEN I SAY "GO!" YOU HOLD YOUR RECEIVER UP TO THE TRANSMITTER!
- READY -
GO!
BR-R-R-ZING!
WE-E-E-E-E-E-E-E!
GR-R-WOW!
SCIENCE LESSON
NO. 20
WHEN THE TELEPHONE RECEIVER IS PLACED NEAR THE TRANSMITTER, ANY SOUND REACHING THE LATTER WILL BE CARRIED BY MAGNETIC COUPLING BACK TO ITS OWN RECEIVER, AND THE SOUND WILL BE REPEATED AGAIN AND AGAIN UNTIL AN EAR-SPLITTING HOWL IS PRODUCED.
W. LEMKIN

CHILD'S TOY



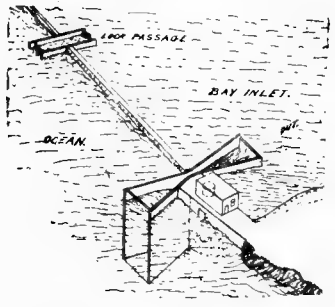
No. 1,666,378, issued to John E. Harner. The toy shown above is propelled by the weight of the child and the swaying of the body to shift the weight. A front wheel is eccentrically mounted and constitutes the driver. This wheel is caused to rotate under the weight of the driver and a shifting of the weight by a to-and-fro movement of the body. The invention provides for the toy to be made in the shape of a flying machine, mounted upon wheels, the rider sitting astraddle of the body.

PRODUCING A SILVER COATING ON GLASS



No. 1,648,504, issued to Luitpold Offenbacher. The apparatus shown here provides for silver coating sheets of glass, and comprises an oval track, a heated drying chamber, and a movable frame which runs on the track. A tub is provided on the table to receive the silver solution. Means is provided for imparting a see-saw motion to the table, so an even coating is obtained.

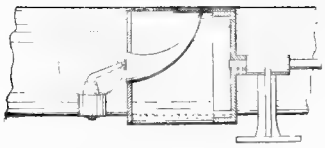
CREATING A HYDRAULIC HEAD



No. 1,623,369, issued to Henry Till. This invention provides a method of producing a hydraulic head in a body of water by creating a depression in its surface between two points along the line of flow. The water runs into the zone of depression from a higher level and is carried away by the stream. This hydraulic head may be used in the generation of power through water turbines and the like.

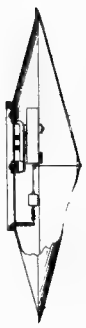
LIGHT CONCENTRATING DEVICE

No. 1,663,308, issued to Charles Francis Jenkins. The device shown here consists of a light source which projects a beam through an aperture in a channel in a rotating cylinder. A light sensitive film is located in front of the small end of the aperture. A funnel-shaped channel is used for directing the light. With this invention a light beam of high intensity in a concentrated form can be applied to a given surface, covering the whole surface by repeated journeys across it, and with as little time loss as possible.



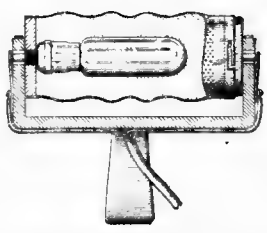
PHONIC DIAPHRAGM

No. 1,604,637, issued to Justin L. Fearing. The loud speaker shown here is a large, direct-acting conical diaphragm adapted for horizontal mounting. The speaker supports the unit and is therefore of the inertia type. An adjusting screw is provided for varying the distance between the diaphragm and the pole pieces.

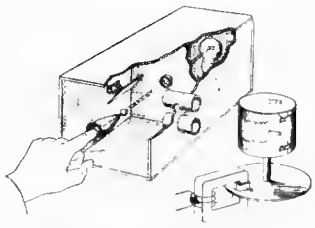


MEDICINAL ROLLER

No. 1,664,000, issued to Jacob H. Weber. The device shown below is used for therapeutic treatments, and consists of a hollow perforated roller mounted on supporting arms. A heating unit is contained within the roller and space is provided for holding salt or other medicinal substances. The roller is passed over the patient's body.



VIBRATION RECORDER

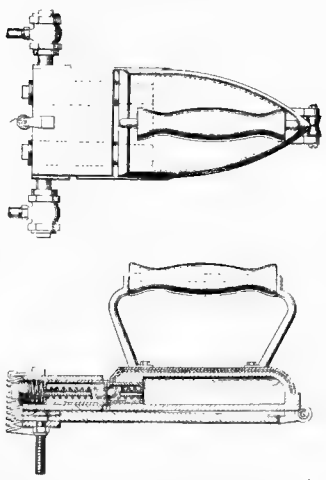


No. 1,664,210, issued to Chester I. Hall. This vibration recorder provides a means for producing a zone of parallel light rays, a spherical mirror and a means for conveying vibrations to the mirror. The light beams are further projected outside of the apparatus, where a drum containing a photo-sensitive paper is revolving at constant speed, so as to obtain a record of the vibrations. Tremors of the human body may thus be recorded.

FIRE EXTINGUISHER

No. 1,663,678, issued to Robert W. Byerly. The extinguisher shown above comprises a metal container and a spring secured to the container, in order to maintain the liquid under pressure. All or part of the container is made of flexible sheet metal, so that variations in the volume of the container may be obtained as well as variations in the pressure.

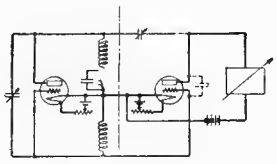
STEAM-HEATED SADIRON



No. 1,660,396, issued to Joseph A. Revill. This invention provides a means for applying steam to an iron which has a hollow steam chamber fitted with valves and inlet and outlet passages. The iron can be heated with the steam and then disconnected from the steam supply while in use. Two views of the iron are shown above. The valves used employ springs for keeping them in a closed position.

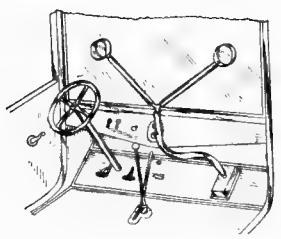
RADIO SIGNALING SYSTEM

No. 1,650,701, issued to John F. Farrington. The signaling system shown here uses an oscillation generator of constant frequency. A variable impedance load is connected to the amplifier and a tuned circuit is provided for establishing the frequency of the oscillations. A balancing condenser is connected between the load and tuned circuit to prevent variations in the load impedance from altering the frequency of oscillations.



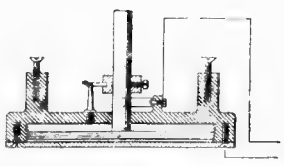
CLEAR VISION DEVICE

No. 1,663,500, issued to Edward A. Kroh. The windshield cleaner shown here has a member for conducting heated air to the windshield. The air is projected upon selected spots of the windshield, keeping them free from water, snow, and the like. Two such frame members are provided and are connected together, so as to receive heated air from the manifold or from the radiator of the automobile.



VARIABLE CONDENSER

No. 1,652,376, issued to Jack D. Sartakoff. The condenser shown below has two plates between which both air and a solid substance are used as dielectrics. The solid substance also precludes any contact between the plates. The dielectric is permanently secured to one of the plates to insure uniformity of operation. When one of the plates is rotated, a threaded connection moves them toward or away from one another, thus changing the capacity. The plates are placed within an insulated casing, thus excluding moisture and dust. A great range of capacities can be covered by this condenser and the frequency has unusually straight-line characteristics.



NOTICE TO READERS: The above illustrated and described devices have recently been issued patent protection, but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses. —EDITOR.

The Oracle

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

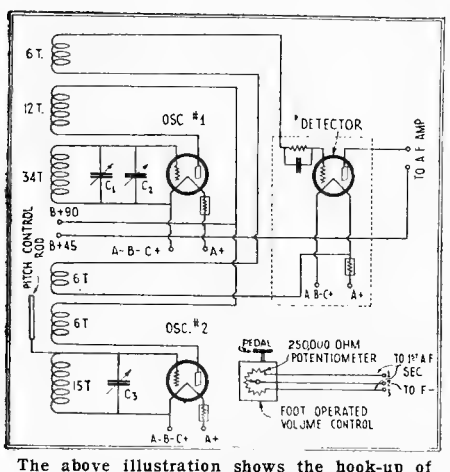
ELECTRIC ORGAN

(2258) C. R. Brittle, Cristobal, Canal Zone, asks:

Q. 1. Please publish a diagram of an electric organ such as that used by Prof. Theremin. Give constructional details if possible.

A. 1. On this page you will find a diagram of an electric organ which will work satisfactorily. It will be noted that the volume control does not involve the use of a quartz crystal frequency regulator such as Prof. Theremin employed. These crystals are expensive and the exact manner in which they were employed in the electric organ is not entirely understood. Prof. Theremin's organ involved two circuits coupled in opposition, which served to create a given volume which could be varied in strength without changing the pitch, by a change in capacity in the loop aerial, as brought about by movements of the left hand.

To avoid complications and make the organ easy to construct, a foot operated volume control is shown. The oscillator coils are wound with No. 22 enameled wire on a 3 inch form. The 34 and 15 turn coils are space wound with the space between each turn equal to the diameter of the wire. Condenser C1 has a capacity of



The above illustration shows the hook-up of an electric organ of simple design which may be constructed by the experimenter.

.0005-mf., C2 is a small vernier condenser, and C3 has a capacity of .00015-mf. When the device is ready for operation, the condenser C2 should be set at about half the maximum capacity and C1 varied about its mid-point until a note is heard. Then, C1 is adjusted by means of a vernier until zero beat is obtained when the operators hand is at its greatest distance from the pitch control rod. If it is found that the highest audible frequencies cannot be obtained by bringing the hand close to the rod, it will be necessary to readjust the oscillator to a higher frequency. This can be accomplished by diminishing the capacity of C1. Do not adjust the oscillators to too high a frequency, as movements of the hand towards or away from the rod will change the pitch too rapidly and the control of the pitch will be too critical. The pitch control rod may vary from one to two feet in length and from one half to one inch in diameter. Prof. Thermin's instrument included apparatus and switches for controlling the percentage of generated harmonics. This additional apparatus has been omitted in the diagram for the sake of simplicity and ease of construction.

SUPERCHARGERS

(2259) F. C. Nelson, Deland, Florida, asks:

Q. 1. Will you please give me some information regarding superchargers, their merits and if they may be used on all types of motor vehicles.

A. 1. Superchargers are now used successfully on racing cars and airplanes. They can be considered practical for private cars, motor coaches, and trucks. If superchargers are installed, considerably smaller engines can be used, as the supercharger pressure will take care of the higher velocity and distribution of the mixture at the higher engine speeds when excess power is required. While testing a car equipped with a supercharger it was found to accelerate more rapidly than other cars. The supercharger increases the power output per cubic inch of piston displacement. It is estimated that with an efficient engine and supercharger, the average car ought to develop about 25 per cent more power. Research work on a supercharged passenger car showed an increase of 18 to 20 per cent in power at 3,000 R.P.M.

Q. 2. Also give some information regarding modern lacquer automobile finishes.

A. 2. Discovery of a method of producing cellulose-nitrate lacquers in a highly concentrated form, of low viscosity, without impairing their film strength makes possible the giving of as much protection with one coat of the present automobile finishing material, as with three or four coats of the earlier lacquers said Dr. G. C. Given, research chemical engineer of E. I. duPont de Nemours & Co., at a recent meeting of the Automotive Engineers. A film of only 8 to 15 thousandths of an inch in thickness of the modern lacquers, suffices to give complete protection to the underlying metal. The modern lacquer consists of a solution of pyroxylin, plasticizer and resin or gum, into which a suitable pigment or combination of pigments has been ground. The material used to dissolve these ingredients is a mixture of solvent and non-solvent, or diluent, in proper ratio. When a lacquer dries, the solvents and non solvents evaporate, leaving a film consisting of the solid ingredients. In the older oil-type paint and varnish finishes the oil takes up oxygen slowly from the air and is thereby changed from a liquid to a solid. Therefore it is said that a lacquer dries by evaporation and a paint by oxidation. The qualities of durability are all influenced by the composition of the lacquer. Too low a ratio of pyroxylin to other clear ingredients will produce a finish that will either craze or check. Too high a ratio will impair the adhesion. The kind of pigment used and the proportion of pigment as compared with the non-pigment solids also have a marked effect on the durability. Actual long-time outdoor exposure of the finished lacquer seems to be the only sure method of testing for this quality. High-grade lacquer finishes are being applied at present with only three minutes drying between coats at 125 degrees Fahrenheit, according to Dr. Given. After the last coat is applied it is advisable to dry for about fifteen minutes at the same temperature before the sanding operation. Adequate ventilation is necessary for the drying chamber, as lacquers dry by evaporation and inhalation of the air contaminated with the vapors is very unsanitary.

RECORDING PHONOGRAPH RECORDS

(2260) R. Saunders, Houston, Texas, writes:

Q. 1. Can you give me information concerning the recording of phonograph records and how this may be done with an electric pick up.

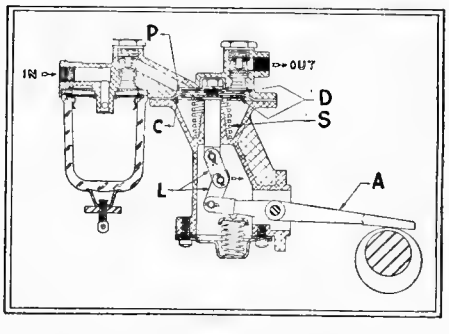
A. 1. Blank records made especially for home recording purposes are available as well as special recording needles. An ordinary phonograph electric pick-up could be used to vibrate the stylus. This unit should be energized by the power output of a high grade transformer coupled audio amplifier or its equivalent. The input to the amplifier may be speech or music supplied through the detector tube of an ordinary radio receiver or a microphone input transformer. When using a microphone, the microphone input transformer must be used in place of the usual audio frequency transformer in most cases, as the ordinary microphone has a much lower impedance than the detector tube.

FUEL PUMP SUBSTITUTE FOR VACUUM TANK

(2261) P. C. Rocanda, Lewiston, Maine, writes:

Q. 1. Will you kindly publish a diagram of a fuel supply system showing the new diaphragm pump as used in airplane engines.

A. 1. On this page you will find illustrated a fuel system using the diaphragm pulsating pump. The diaphragm itself consists of several layers of specially treated flexible cloth material which is impervious to gasoline and benzol. The cloth material, C, is held between two metal discs, D, and is pushed upward by a spring, S. The diaphragm in its upward position almost fills the pump chamber, P, so that in its downward movements, a vacuum is obtained. Repeated one-quarter inch movement of the diaphragm will not wear out the flexible material for a great length of time. Extreme movement of the diaphragm occurs only when the carburetor is empty. When full this



A fuel pump substitute for the vacuum tank is illustrated above. This pump is of the diaphragm pulsating type and is now being used on airplane and automobile engines.

movement is greatly diminished. In practically all normal conditions when the engine is running, the diaphragm is pulsating in a movement of only a few thousandths of an inch. This reduced range of action does not wear it out except very slowly. The movement is controlled by the linkage, L, because when the diaphragm is in the depressed position, due to sufficient fuel in the carburetor, the reciprocal movement of the lever, A, will merely cause a movement of the linkage, L, to the right, as shown by the arrow. These pumps can be used with automobile as well as airplane engines. They eliminate the old vacuum tank.

RUST PREVENTION

(2262) C. E. Wiltsey, Caldwell, N. J., asks:

Q. 1. Will you publish a formula for a solution which can be applied to iron or steel in order to prevent rust?

A. 1. The following solution is recommended for rust prevention:

Bismuth chloride	1 part
Mercury bichloride	2 parts
Copper chloride	1 part
Hydrochloric acid	6 parts
Alcohol	5 parts

Water sufficient to make 64 parts.

Mix. As in all such processes a great deal depends upon having the article to be treated absolutely clean and free from grease. Unless this is the case uniform results are impossible. The liquid may be applied with a swab, or a brush, but if the object is small enough to dip into the liquid better results may be obtained than in any other way. The covering thus put on is said to be lasting, and a sure protection against oxidation.

A Western Classic With a Thousand Thrills!

WHEN Tom Banning rode into Buenas Noches on a Circle Dot roan to look up his uncle who had located the lost Eagle-tail gold mine, he loped into six-gun trouble. Murderous men marked him down for death. Followed him like gray ghosts along the trail until that eventful day when he turned on his pursuers and called for a showdown with blazing guns. Did he win? Read the thrilling answer in

The Mystery of Skull Canyon

By H. Bedford-Jones

The roar of six guns echoed through the canyon. Banning's gun spoke and Hartley fell to the ground

in the JULY issue of

25c

Fawcett's **Triple-X Western** Magazine

OUT TODAY

In addition to the top-notch western stories this month there's an added treat in store for Triple-X readers in

THE BOCHE BUSTERS

By Richard Martinsen

It took two outfits from the cow country to show Army Headquarters how to mop up the German trenches.

THE SKY-SHOOTING FOOL

By Raoul Whitfield

The story of a daredevil American "ace" who challenged a German combat group and showed them what real fighting was.

BATTLE STORIES, the big, new magazine of thrilling tales of the army, navy, and marines is on sale the 20th of each month. The July number is a knock-out!

Triple-X, Fawcett Publications, Inc.,
Minneapolis, Minn.

Inclosed find $1 (bill or stamps) for which send me TRIPLE-X for the next 5 months.

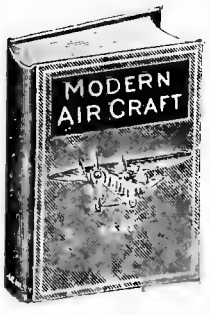
Name. . . . . .

Address. . . . . .

City . . . . . State . . . . . .

-in all its phases!

Complete instruction course in three volumes. Every point of aviation efficiently and thoroughly treated. Subjects covered in these volumes—



MODERN AIR CRAFT

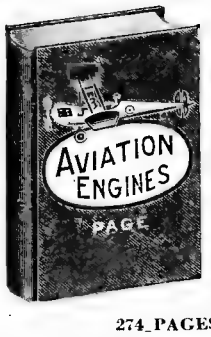
700 Pages

500 Illustrations

Contents of each chapter — I. Aircraft Types. II. Lighter-than-Air Craft. III. Early Airplane Designs. General Design Considerations. IV. Design and Construction of Aerofoils. V. Arrangement, Fabrication and Bracing of Airplane Wings. VI. Airplane Fuselage and Landing Gear Construction. VII. Airplane Power Plant Types and Installation. VIII. Aviation Engine Design and Construction. Air-Cooled Engines. IX. Aviation Engine Design and Construction. Water-Cooled Engines. X. Aviation Engine Auxiliaries. XI. Aircraft Propeller Construction and Action. XII. Airplane Equilibrium and Control Principles. XIII. Uncrating, Setting Up and Aligning Airplane. XIV. Inspection and Maintenance of Airplanes and Engines. XV. Details of Modern Airships and Airplanes. XVI. Seaplanes, Flying Boats, Amphibians and Other Aircraft. XVII. Some Aspects of Commercial Aviation. XVIII. Aircraft Instruments and Aerial Navigation, XIX. Standard Nomenclature for Aeronautics Report No. 240, Part I.

This book is written in simple, understandable language.

PRICE $5.00



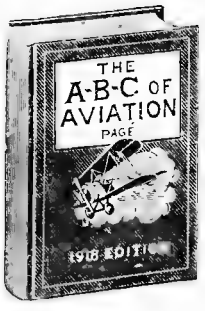
AVIATION ENGINES

This treatise, written by a recognized authority on all of the practical aspects of internal combustion engine construction, maintenance, and repair, fills the need as no other book does. The matter is logically arranged, all descriptive matter is simply expressed and copiously illustrated, so that anyone can understand airplane engine operation and repair even if without previous mechanical training. This work is invaluable for anyone desiring to become an aviator or aviator mechanician.

274 PAGES **PRICE $1.25**

A. B. C. OF AVIATION

This book describes the basic principles of aviation, tells how a balloon, or dirigible is made, and why it floats in the air. Describes how an airplane flies. It shows in detail the different parts of an airplane, what they are, and what they do. Describes all types of airplanes and how they differ in construction, as well as detailing the advantages and disadvantages of different types of aircraft. It includes a complete dictionary of aviation terms and clear drawings of leading airplanes



PRICE $1.25

Remit by cash, stamps, check, or money order.
No C.O.D.'s

We Pay Postage On All Books

CONSRAD COMPANY, Inc.
230 FIFTH AVENUE NEW YORK

HOME-MADE FIREWORKS

By E. R. HAMBURGER, Ph.D.

(*Continued from page 235*)

into a tube about ⅝-inch internal diameter, and about 3 inches long. Plug one end with ½-inch of clay. Fill with colored fire, insert fuse, and cap with tissue paper.

If preferred, instead of preparing a special case, ordinary soda straws may be used. To fill, close one end by folding over. Fill by inserting the open end into the pile of chemicals, and tapping to make the powder settle at the bottom.

To make a fuse, prepare a concentrated solution of potassium nitrate by dissolving about a teaspoon of the salt in half a glass of water. In this solution soak a piece of soft twine. Remove, and allow to dry thoroughly. The fuse is then ready for use. Frequently an untreated string will prove every bit as satisfactory.

RED FIRE

TO make Red Fire, mix 10 measures of powdered potassium chlorate, 8 measures of granulated white sugar, and 5 measures of strontium carbonate. If more convenient, strontium nitrate can be substituted for the strontium carbonate. Mix, as described above, by rolling in a sheet of paper. A measure can be any measure of volume, such as a teaspoon, cup, scoop, etc.

A beautiful purple-blue flame with an inner red cone is obtained from Blue Fire, which consists of 15 measures of powdered potassium chlorate, 12 measures of granulated white sugar, 4 measures of powdered copper sulphate, and 7 measures of powdered calomel. Mix as already directed.

YELLOW FIRE

PERHAPS Yellow Fire is desired. To make this, mix 5 measures of powdered potassium chlorate, 4 measures of granulated white sugar, and 4 measures of powdered washing soda. Before using the washing soda, expose to the air for a few days in order to remove all water of crystallization.

If green is your favorite color, a beautiful shade is obtained from Green Fire. Mix in the usual fashion 5 measures of powdered barium chlorate with 4 measures of granulated white sugar, and ignite.

These various colored fires can be ignited in succession, thus providing a fascinating panorama of colored flames. Although it is more workman-like to pile each mixture in a case or "firepot," it is not essential. The Red, or Blue, or Green Fire, as fancy dictates, can be placed in a shallow tin pan and ignited, out of doors, of course, and at night. Those readers who are artistically inclined can form interesting patterns by filling a number of soda straws with different colors, and arranging in a clay or earth block. Ignite quickly by attaching a match to a long stick, and STEP BACK AT A SAFE DISTANCE. In arranging the color design, be careful not to place one straw in front of another, inasmuch as a cloud of smoke is given off, which would mask any design behind it.

ROCKETS

THE oldest forms of fireworks are undoubtedly the humble cracker and rocket, the mixture in both consisting essentially of gun-powder. Tradition states that the rocket was originally devised ages ago by priests who represented it to be the living spirit of flame, which, at the priestly command, mounted from earth to heaven by its own power as the messenger of the fire god.

Before the development of modern warfare attempts had been made to use rockets as effective weapons. We are all familiar with the "rocket's red glare" of the Revolutionary War, as expressed in the *Star-Spangled Banner*. The Hindus also used rockets as incendiary agents in a mutiny against England. As ammunition, however, rockets were rather ineffectual. Today they are used, not only as fireworks, but as signaling devices, both in war, and by ships in distress at sea.

Although the ingredients which fill the case of a rocket are the same, both with respect to kind and proportions as those comprising gun-powder, the filling is not gun-powder, inasmuch as the ingredients are less intimately mixed. As a result, instead of the mass exploding instantly, as with gun-powder, only the exposed mass burns violently. In burning, a large amount of gas is generated. This gas escapes at the base of the rocket. Here the recoil or reaction produced by the rush of gases and paartially consumed matter projects the rocket forward. The principle involved is illustrated in the recoil of a gun. Sky-rockets have sticks attached, so that the path of the rocket in fligh. is directed, and a cap which contains stars, etc. The latter opens in flight.

IN "RADIO NEWS" FOR JULY, 1928

*A Sturdy and Dependable "B" Power Unit
*A "Junk Box" Short-Wave Receiver
*A Crystal Set for the Beginner
Modernizing the Atwater Kent Model 20
A Simple Remote-Control Unit
Intermediate Amplification with Screen-Grid Tubes
Radio Wrinkles
Radio Constructors' Correspondence

* Free Blueprint Articles.

In order to obtain the greatest possible reaction from the burning composition, the case is "choked," i.e., constricted so that the fire issues in the form of a jet. Obviously, this constriction reduces the burning surface. In order, therefore, to increase the latter as far as possible, a hollow opening is arranged throughout the center of the rocket case. This peculiar arrangement makes it impossible for the inexperienced experimenter to duplicate a rocket with any degree of success.

SPARKLERS

THE scintillating effects found in sparklers and fountains are due to the burning of particles of metals. The very method by which the Chinese obtained their fire drew attention to the fact that bits of metal gave forth brilliant sparks while burning, for their source of fire was the rubbing of iron pyrites on a bit of flint. Naturally, particles of pyrites would fall into the fire. Pyrotechnists of the seventeenth and eighteenth centuries give elaborate directions for the preparation of powdered iron to be added to gun-powder, forming the composition known by the poetic name of "golden rain." In the nineteenth century a new era was started with the introduction of magnesium in fireworks in 1865, and of aluminum in 1894.

A fascinating fountain may be prepared as follows: Prepare a "firepot" case, as already described (or the composition may be burned in a pile on a tin plate). Fill with the following mixture: 5 measures of powdered potassium chlorate, 4 measures of

granulated white sugar, and 4 measures of powdered aluminum. Mix thoroughly in the usual manner and ignite either by means of a fuse, or directly by a match. Brilliant streams of white stars are thrown off in a fountain effect.

To make sparklers, take a wire, coat with melted paraffin, allow the latter to cool a trifle, and roll in the above fountain mixture before the paraffin has had time to harden.

ROMAN CANDLES

ROMAN candles probably originated in England about 1600. They are, in reality, a modified rocket. In preparing a Roman candle the case is filled with a series of repetitions of the following: first, Roman candle fuse, or "golden rain," then a colored star, and lastly, the blowing charge, or gunpowder. The fuse burns with a fountain effect, and, when exhausted, lights the star, flashes around the latter (for the star is smaller than the case) and fires the blowing charge, which in turn propels the star from the case, simultaneously igniting the next layer of fuse. The action is repeated till the case is exhausted.

It is rather difficult to duplicate a Roman candle, inasmuch as success depends to a large extent upon an intimate mixing of the ingredients, and upon the qualities of the charcoal used. Prepare a case of heavy paper or cardboard about a foot or more long, depending upon the number of stars used. The internal diameter should be about ½-inch. Close one end of the case with 3 inches of clay, ramming it in. Use this end as a handle by which the candle is held while in action. Pour in a 1-inch layer of "golden rain" fire, followed by ½-inch layer of gun-powder. Then add a star. Continue till the case is filled, ramming *very* lightly. The last layer should be "golden rain," resting above a star. Cap with tissue paper and insert a fuse.

GOLDEN RAIN

TO prepare "golden rain," mix thoroughly, as described above, 2 measures of powdered potassium nitrate, 3 measures of powdered charcoal, and 1 measure of powdered sulphur. Under no conditions should the ingredients be ground together.

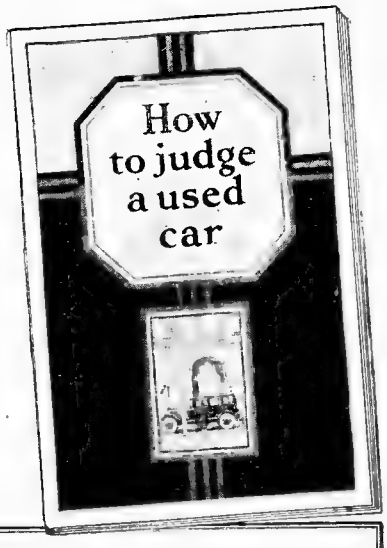
To prepare gun-powder, mix thoroughly, in the usual manner, 28 measures of potassium nitrate, 15 measures of powdered charcoal, and 6.5 measures of powdered sulphur. Do not attempt to grind the ingredients together.

COLORED STARS

TO prepare colored stars, take any of the colored fire mixtures, and form into a thick paste with the smallest amount of shellac possible. Do not use water. Cut or mold into shape, and allow to dry. Remember to make the stars narrower than the inner diameter of the case, so that the "golden rain" can flash around the star and ignite the gun-powder. If the inner diameter of the case is ½-inch, a star ¼-inch thick and 5/16 of an inch in diameter should prove to be of a satisfactory size. A glance at the diagram will indicate more clearly the exact structure of a Roman candle.

In conclusion, I would like to quote Faber's conception of the development of fireworks: "Many varieties of substances possess a lively tendency, under suitable conditions, to combine with oxygen, and to do this with such violence as to yield products that are both hot and luminous to an intense degree. This is the manner in which fire generally comes into being. In the matter of ordinary burning, the dependence for a sufficient supply of oxygen is upon the air. But there exist certain solid substances containing oxygen in combination with other elements, from which substances the elements may be released so readily, and to such an extent as to result in combustion of extraordinary energy.

INVEST 2¢
. . . you may save $200!
Write us *now* for your copy of *this free book*



THE fund of facts in "How to Judge a Used Car" may easily save you $200 or more in buying a used car! Boiled down into ten minutes' interesting reading are the safeguards experienced *automobile dealers* apply when *buying* used cars for resale. Every paragraph is the summary of years of experience—every page is full of time-saving, money-making pointers.

Pictures and text in this helpful used car manual give startling information never before made public. They show *you* what code prices mean, why dealers turn the speedometer back to zero, how to fix the value of a used car offered by a friend, how to avoid "orphans"—and other important points the average buyer might overlook.

Send the coupon *now* for your copy. Learn how to get more for your motoring money. Invest 2c in a postage stamp — you may save $200!

Pledge to the Public
on Used Car Sales

1 Every used car is conspicuously marked with its price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.

2 All Studebaker automobiles which are sold as CERTIFIED CARS have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.

3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

1927. The Studebaker Corporation of America.

Sign and mail the Coupon NOW!

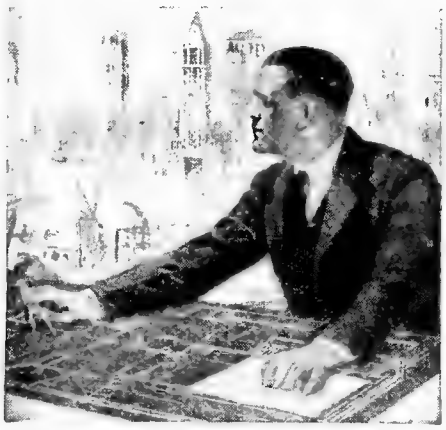
THE STUDEBAKER CORPORATION OF AMERICA, Dept.G-63, South Bend, Ind.
Please send me my copy of your valuable free booklet, "How to Judge a Used Car."

Name.....

Street.....

City ..... *State* .....

STUDEBAKER
The Great Independent



Former Plasterer Now Earning $12,000 a Year

"When I enrolled with the International Correspondence Schools, I was a plasterer and I didn't know a thing about blueprints. Today I have my own contracting business and I am able to figure the most difficult jobs and execute them to the satisfaction of everyone concerned. My income is between $12,000 and $15,000 a year. It certainly was a lucky day for me when I sent in that I. C. S. coupon."

That's a true story of what just one student of the International Correspondence Schools has done. Every mail brings letters from other ambitious men and women telling of promotions and increases in salary due directly to spare-time study.

One hour a day spent with the I. C. S., in the quiet of your own home, will prepare you for success in the work you like best.

Mail Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 6238-E, Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars on the subject *before* which I have marked X:

☐ Architect	☐ Window Display
☐ Architectural Draftsman	☐ Plumber and Steam Fitter
☐ Architects' Blueprints	☐ Electrical Engineer
☐ Contractor and Builder	☐ Electric Lighting
☐ Building Foreman	☐ Mechanical Engineer
☐ Concrete Builder	☐ Show Card and Sign Lettering
☐ Structural Engineer	☐ Industrial Management
☐ Structural Draftsman	☐ Secretarial Work
☐ Heating and Ventilation	☐ Business Correspondence
☐ Plumbing Inspector	☐ Bookkeeper
☐ Foreman Plumber	☐ Stenographer and Typist
☐ Sheet Metal Worker	☐ Higher Accounting
☐ Surveying and Mapping	☐ Common School Subjects
☐ Civil Engineer	☐ Mathematics ☐ English
☐ Electric Wiring	☐ Illustrating
☐ Telegraph Engineer	☐ Railway Mail Clerk
☐ Practical Telephony	☐ Civil Service
☐ Mechanical Draftsman	☐ Mining Engineer
☐ Toolmaker	☐ Gas Engine Operating
☐ Machine Shop Practice	☐ Textile Overseer or Supt.
☐ Chemist	☐ Traffic Manager
☐ Pharmacy	☐ Automobiles
☐ Navigation	☐ Airplane Engines ☐ Spanish
☐ Salesmanship	☐ Agriculture ☐ French
☐ Advertising	☐ Poultry Raising ☐ Radio

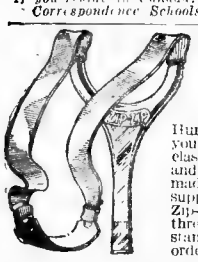
Name . . . . . .

Street Address . . . . . .

City . . . . . State . . . . . .

Occupation . . . . . .

If you reside in Canada, send this coupon to International Correspondence Schools Canadian, Limited, Montreal



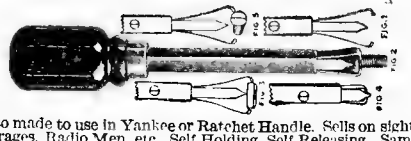
ZIP-ZIP SHOOTER

LET'S GO, BOYS

Hunting, fishing, or camping, wherever you go you will need a Zip-Zip Shooter, elastic and lasting, with plenty of pep and force, scientifically and practically made. See your dealer—if he can't supply you order from us. Zip-Zip Shooter, 35c., or three for $1.00; send stamps, coin, or money order

AUTOMATIC RUBBER CO., Dept. BB, Columbia, S. C

SALESMEN! $100 WEEKLY
SELL COX HOLDFAST SCREWDRIVERS



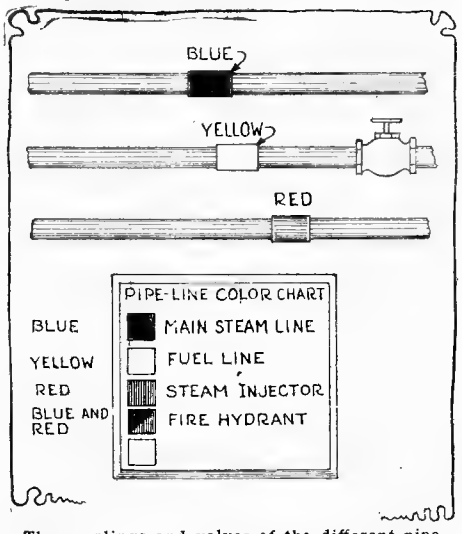
Also made to use in Yankee or Ratchet Handle. Sells on sight to Garages, Radio Men, etc. Self Holding, Self Releasing. Sample and proposition, 50c. **S. J. COX, Dept. J, Franklin, Pa.**

Hints for the Mechanic

Mechanics' needs have caused us to start this new department—"Hints for the Mechanic," in which we intend to publish wrinkles useful to mechanics in general. You can help us with this department by writing a brief description of your favorite shop wrinkle and sending this to the editor of this department, together with a pencil or pen and ink sketch of the wrinkle. The ideas published herewith will give you some idea of what we want. Our draughtsmen will make the necessary mechanical drawings, so you need not send us finished drawings. We will pay $10.00 each month for the best Wrinkle or Hint sent in; others published will be paid for at space rates. Address all letters to Editor, Hints for the Mechanic Department, in care of this magazine.

FIRST PRIZE $10.00

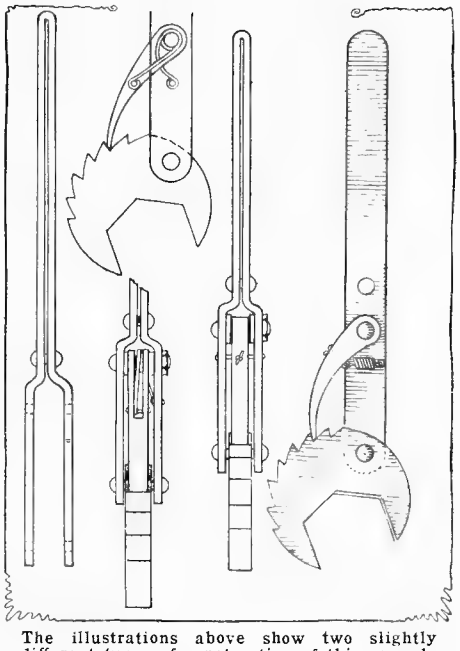
COLOR MARKS FOR PIPES



The couplings and valves of the different pipe systems are painted with the identifying color indicated on the chart.

In large plants and factories where a great number of pipe-lines are used it is almost impossible to trace any particular pipe-line for necessary repairs, as all lines are generally painted the same color. The color chart should be hung in a conspicuous place, and when a failure occurs a repair can be made without loss of time due to difficult tracing.—*H. R. Wallin.*

SPECIAL WRENCH

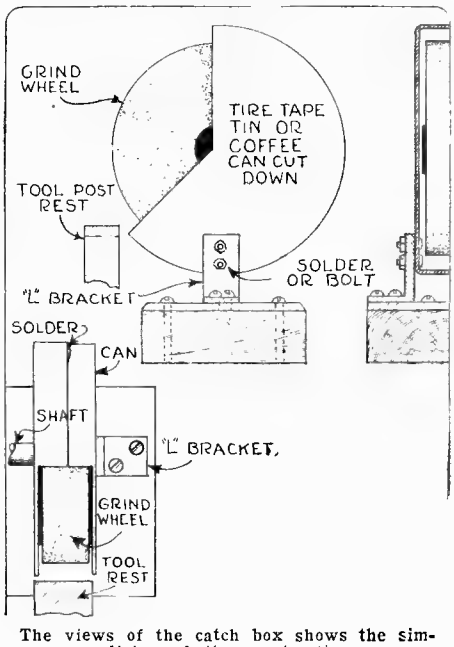


The illustrations above show two slightly different types of construction of this wrench.

This wrench might be called a "dire emergency" wrench, as its peculiar construction is advantageous only in those cases where the ordinary "S" wrench cannot make even a one-sixth turn. This wrench will tighten any nut, even in those cases where the wrench handle can only be swung through an arc of about 15 degrees.—*Contributor, please send name.*

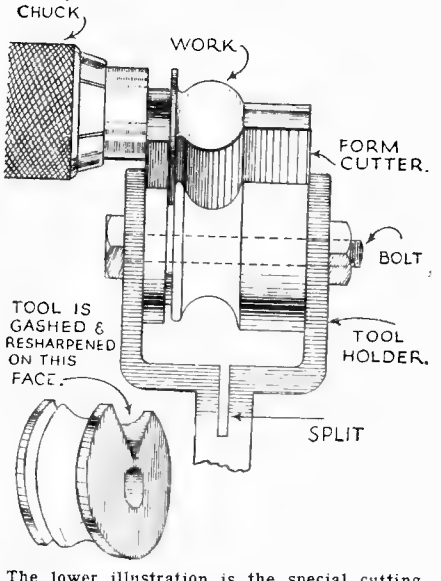
GRINDSTONE CATCH BOX

IT is highly desirable to use a catch box and hood, such as described here, for the sake of cleanliness, and for the more important feature of safety. An empty tin box of the type used as a container for electricians' tape serves as the hood of this grinding wheel filing catcher. A sector is cut from the lid of the container, and a similar sector is cut from the can. The sector made from the lid of the can is cut away at its center so that the shaft of the grinding wheel can pass through it.—*R. B. Wailes.*



The views of the catch box shows the simplicity of its construction.

LATHE TOOL



The lower illustration is the special cutting tool, the other view shows the tool in action.

The construction of this tool is such that it may easily be resharpened without changing the shape of the cutting edge. The tool has a remarkably long life, as about three-fourths of the tool steel must be ground away before discarding the tool.—*G. A. Luers.*

Wood-Turning for the Amateur

By H. L. WEATHERBY

(*Continued from page 233*)

With the experience acquired in shaping this simple cylinder, try the two following exercises, which involve exactly the same processes and are called "shoulder cut" exercises. Care must be taken to keep the shoulders square and the surfaces smooth. Do not use sandpaper, and master the skew chisel.

The V-cut, or the final exercise in this group, is fashioned in the same manner that we use in cutting the ends. Using the point of the small skew, at right angles to the revolving cylinder, cut in on the center lines to a depth of about ⅛". Now turning the skew chisel at an angle, and pivoting on the tee-rest, cut in from both sides toward the center of the cut. Repeat this operation until a 90-degree V is formed, having smooth sides. Try the pivot movement until skill on this operation is attained; always keeping the point of the chisel pointed toward the center of the block.

Next month we will take up concave and convex cuts; after which we will be ready for some applications of our practice work in some articles of furniture.

To summarize: 1—Get good tools, and then keep them sharp. A good workman cannot do good work with dull tools. 2—Center stock and place in lathe. 3—Start at slow speed. 4—Rough off with gouge. 5—Increase speed of lathe and with parting tool, mark to big diameter. 6—Smooth to bottom of marks and avoid scraping. 7—Cut to length, and last but by no means least: Keep on trying until skill is acquired on these or similar exercises.

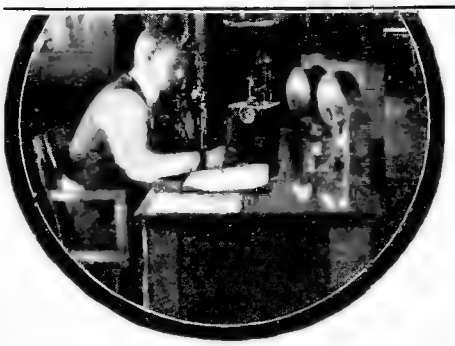
RULES FOR MODEL CONTEST

(*Continued from page 231*)

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based on: A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against drainage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the September contest must reach us on or before the 25th of June.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

— In Next Issue —
Don't Miss
"ANIMAL SUPERSTITIONS"

Go After the Big-Pay Job!



"Know electricity as experts know it and get an expert's pay"

DON'T be satisfied to worry along in little jobs with little pay. Master the finer points of electrical practice and bring the big-pay job within your reach. The man who knows electricity in all its many phases—the man who has completely mastered the subject from A to Z—can pick his own job and name his own salary. Learn the way to bigger pay. Become an electrical expert. Croft will show you how. Through his famous books he will teach you electricity as experts know it and put you in line for an expert's pay. Fifty-nine thousand men are using these books to step ahead—WHY NOT YOU?

Croft Library of Practical Electricity

8 volumes—3000 pages—2100 illustrations, flexible binding

No method of teaching electricity offers a quicker, surer way to success than the Croft books.

Starting right in with the ABC's of modern electricity, Croft takes you through his books in easy steps. He gives you the boiled-down records of every-day electrical practice in plain words, figures and illustrations. Nothing is left to the imagination—there is no guesswork.

59,000 Croft Sets NOW IN USE

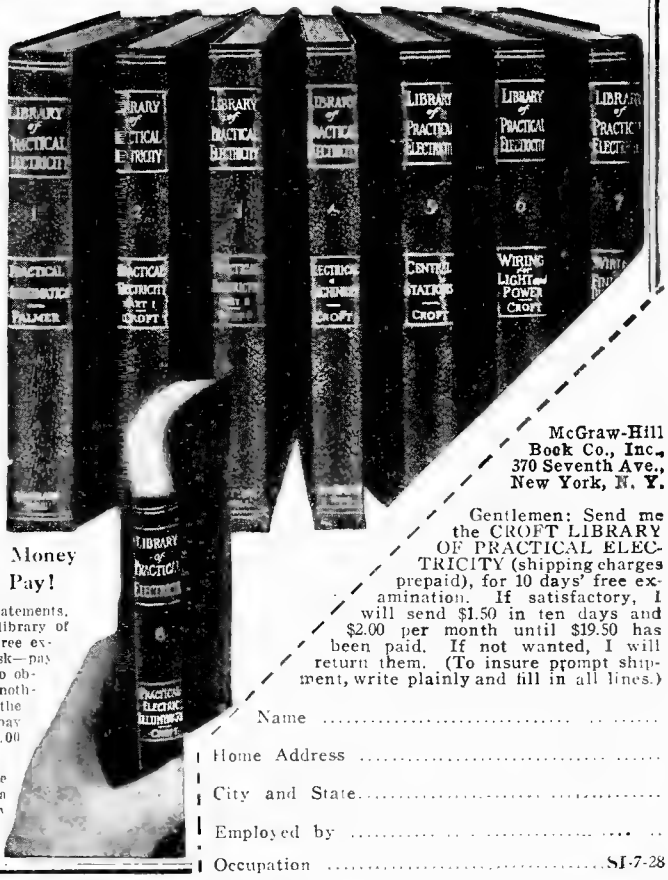
Croft has been through the mill. His knowledge of electricity has been gained by actual shirt-sleeve contact with electrical problems. He knows just what is needed to get ahead. He has poured out all his knowledge—all his experience—in language that anyone can grasp. Yet the text is so scientifically correct that thousands of the highest-paid electrical engineers are using the books as a reference set.

The famous set is, beyond the shadow of a doubt, the last word in practical electrical education. No one who wishes to get anywhere in the electrical field can afford to be without it.

Thousands of Facts at Your Finger Tips

The Croft Library contains three thousand pages, with twenty-one hundred of the clearest illustrations ever put into book form. Each of the eight flexible pocket-size volumes is indexed so that everything you need to know is right at your finger tips.

Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—installation, operation and repair of electrical machinery—wiring for light and power—wiring of finished buildings—underwriter's and municipal requirements—how to do a complete job, from estimating it to completion—illumination in its every phase—the latest and most improved methods of lighting, etc.



The Standard in Practical Electrical Training

Everywhere the Croft Library is acknowledged as the standard — the leader—in practical electrical training. It is the daily guide of 59,000 highly paid electrical workers and engineers. There is nothing like it. It is the most complete, the best illustrated, the most carefully compiled, the most easily understood library in print today. No matter how much or how little you know of electricity you will find the Croft Library a sound, helpful guide to greater accomplishment.

Free Examination—No Money Down—10 Months to Pay!

So that you may test our statements, we offer to send the complete library of 8 volumes to you for 10 days' free examination. We take all the risk—pay all the charges. You assume no obligation of any kind—you pay nothing unless you decide to keep the books, in which event you pay $1.50 in ten days and then $2.00 a month for nine months.

Send the coupon now and see the books for yourself. It's a little thing to do but it may prove to be the best move you ever made in your life.

McGraw-Hill Book Co., Inc.,
370 Seventh Ave.,
New York, N. Y.

Gentlemen: Send me the CROFT LIBRARY OF PRACTICAL ELECTRICITY (shipping charges prepaid), for 10 days' free examination. If satisfactory, I will send $1.50 in ten days and $2.00 per month until $19.50 has been paid. If not wanted, I will return them. (To insure prompt shipment, write plainly and fill in all lines.)

Name .....

Home Address .....

City and State .....

Employed by .....

Occupation SI-7-28

Do you buy advertised goods?

Of course you do; everybody does. Just run over in your mind the various articles that you have purchased in the last week or the last month. How about foods? Your breakfast fruits, cereals and bacon are all advertised. Probably that is how you first came to know of them —through advertising. Probably the shoes you are wearing, or the dress or suit you have on are equally well-known advertised makes, and you are proud of them.

In the home. On the floor are rugs and linoleum—the better wearing kinds are extensively advertised. What about the kitchen? Aluminum ware, gas ranges, hot water heaters, dish and clothes washers, cooking utensils of all kinds —practically everything you use is advertised. You buy advertised products because you have confidence in them. You know that a manufacturer cannot afford to advertise shoddy or unworthy merchandise.

Advertising is one form of insurance. It gives you a feeling of perfect confidence and safety when you ask for an advertised brand, for you know that you will get the quality and service you expect. The name is the guarantee.

The more you read advertising the more you will know about human progress. You will become well posted in almost every line of human endeavor and a canny judge of values. Reading advertisements is a fine habit. Cultivate it.

* * *

Read the advertisements and buy advertised goods. They are the safest investment

FOREST RANGERS

Men, get Forest Ranger job, $125-$200 month and home furnished; hunt, fish, trap, etc. For further details, write
NORTON INST.
1542 Temple Court, Denver, Colo.

Can You Sell Gas At 5c Per Gal.?

If so, write me quick. My distributors make as high as $3,000.00 per month. Let me show you how.
SEND FOR FREE TRIAL
Proof of astounding success and my $15.00 a day Guarantee to Distributors

Frank Andrews, Dept. 863-K.B., 154 E. Erie St. CHICAGO, ILL.

Learn ELECTRICITY in Los Angeles

Practical training by National's tested job-experience method. All branches of electricity; radio. Life scholarship. 17000 successful graduates. Million-dollar institution. 23rd year. Write for FREE illustrated catalog.
National Electrical School
Dept. 286 Figueroa & Santa Barbara Sts., Los Angeles, California

A SHIP MODEL FOR $4.98

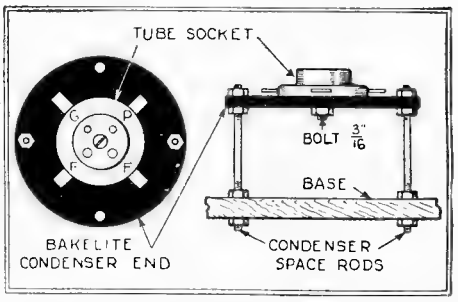
Build a ship for your home of the old antique type Santa Maria, Mayflower and La Pinta for $4.98, and the Old Ironsides for $6.98, plus postage, for which we furnish all parts, cut to fit and diagram telling you just how to assemble these ships. No tools necessary. We also have a complete line of assembled models. Write for our illustrated catalogue
MINIATURE SHIP MODELS, INC.
Dept. S-9, 3818-24 Baring St., Phila., Pa.

Insure your copy reaching you each month. Subscribe to Science and Invention—$2.50 a year. Experimenter Publishing Co., 230 Fifth Avenue, N. Y. C.

Radio Wrinkles

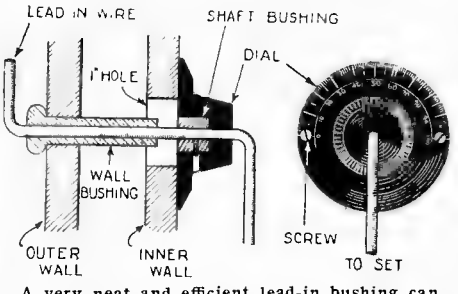
RADIO WRINKLES accepted and published will be paid for at regular rates

SUPPORTING TUBE SOCKETS



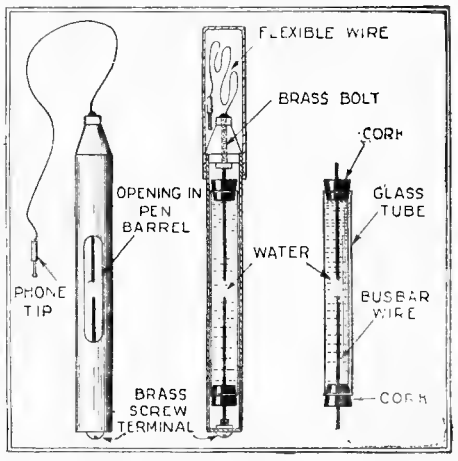
The bakelite end plates from an old condenser afford a sturdy support for tube sockets and other pieces of apparatus. The end plate of bakelite is fixed to the baseboard by the spacer rods of the old condenser. The tube socket is fixed to the bakelite end plate by a bolt which passes through its middle. This makes an excellent support for tube sockets, as well as for other pieces of apparatus. The construction is shown plainly in the above drawing.—E. F. Shawver. 5QU., Rep. 24229.

LEAD-IN BUSHING



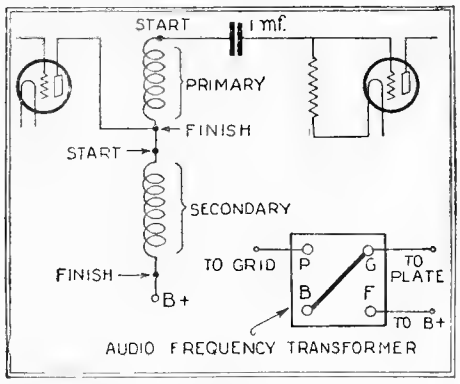
A very neat and efficient lead-in bushing can be made as indicated in the above drawing. The outer wall is bored to receive an ordinary porcelain wall bushing. Directly opposite this hole, a one inch hole is bored in the inner wall. An old dial is then drilled through the knob as indicated. Two holes for wood screws are also provided. The dial is then put into place over the large hole and fixed there with wood screws. The lead-in wire is then brought through the dial and the set screw on the dial tightened to hold it fast.—E. F. Shawver, 5QU, Rep. 24229.

POLARITY INDICATOR



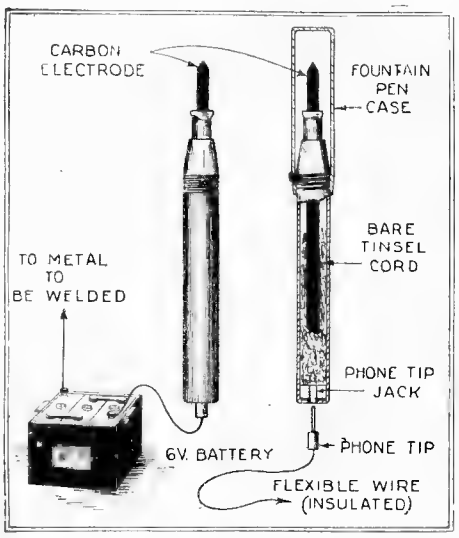
A handy polarity indicator can be made from an old fountain pen. The insides of the pen are removed and an oblong hole is cut in the barrel as shown. A glass tube is then obtained which will fit within the barrel snugly. A cork is pushed into each end of this tube and two lengths of bus-bar wire are forced through the corks with their ends separated about one-eighth inch. The glass tube is filled with water to which a pinch of salt has been added. When the two wires of this tube are held to the terminals of a battery, bubbles will form around the negative electrode.—Herman R. Wellin

QUALITY FROM CHEAP A. F. T'S.



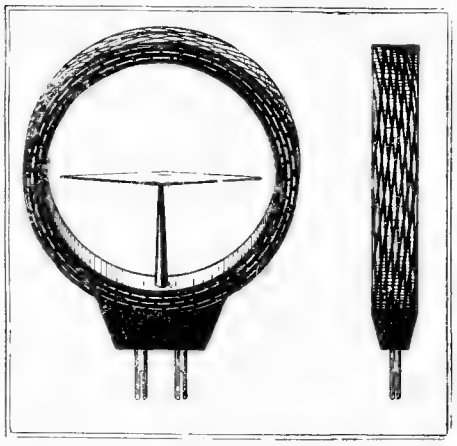
By connecting the cheap variety of audio frequency transformers as autoformers, rather than in the usual way, good quality can be obtained from them. This is accomplished by connecting the start of the primary winding to the grid of the tube through a 1 mf. blocking condenser. The end of the primary and start of the secondary are connected together and also to the plate of the preceding tube.—B. B. Bryant.

FOUNTAIN PEN SOLDERING KIT



A very handy welding outfit suitable for radio work can be made from an old fountain pen as shown in the illustration. The penpoint is removed and a small carbon rod or soft lead from a pencil is pushed into this opening. A length of flexible cord is fitted with a phone tip and a phone tip jack is placed in one end of the pen. The barrel of the pen is filled with tinsel cord which makes contact with the carbon rod. —Herman R. Wallin.

SENSITIVE GALVANOMETER



An extremely sensitive galvanometer which will indicate minute currents can be constructed as shown in the above illustration. A needle, such as that used on small compasses, is pivoted on a support and is placed in the center of a honeycomb coil. The coil should be a large one having about 1,000 to 1,500 turns. If a smaller size coil is used, the device will not be so sensitive.

Telephone service, a public trust

An Advertisement of the American Telephone and Telegraph Company

THE widespread ownership of the Bell Telephone System places an obligation on its management to guard the savings of its hundreds of thousands of stockholders.

Its responsibility for so large a part of the country's telephone service imposes an obligation that the service shall always be adequate, dependable and satisfactory to the user.

The only sound policy that will meet these obligations is to continue to furnish the best possible service at the lowest cost consistent with financial safety.

There is then in the Bell System no incentive to earn speculative or large profits. Earnings must be sufficient to assure the best possible service and the financial integrity of the business. Anything in excess of these requirements goes toward extending the service or keeping down the rates.

This is fundamental in the policy of the company.

The Bell System's ideal is the same as that of the public it serves—the most telephone service and the best, at the least cost to the user. It accepts its responsibility for a nation-wide telephone service as a public trust.

Buy Direct from Swiss Importer and Save 50%
14 Karat Solid Gold Effect WATCH Knife and Chain and Cigarette Lighter Pistol
Written guarantee given with this 14-kt. solid gold effect watch, jewelled movement, tested, adjusted, accurate timekeeper, 25-year case, Waldemar knife, chain, also pistol shape cigarette lighter. Send no money. Pay postman only $3.59 for all 4 articles. JENKINS, 621 Broadway, N.Y., Dept. 65M7
$3.59

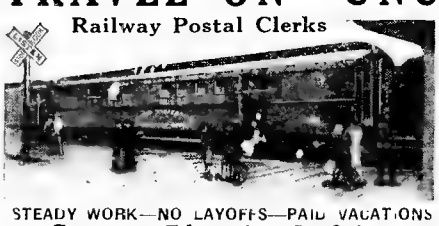
Learn Penmanship
I can make a good penman of you at home during your spare time. Write for my FREE BOOK. "HOW TO BECOME A GOOD PENMAN." Your name elegantly written on a card if you enclose stamp. Write today.
F. W. TAMBLYN, 424 Ridge Bldg., Kansas City, Mo.

TRAVEL ON "UNCLE SAM'S" PAYROLL

Railway Postal Clerks

$158 to $225 a Month

Mail Coupon Before You Lose I



STEADY WORK—NO LAYOFFS—PAID VACATIONS

Common Education Sufficient

Many Other Government Jobs Obtainable

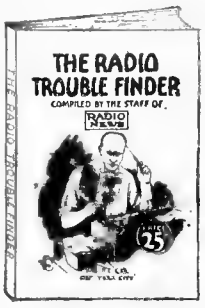
FRANKLIN INSTITUTE, Dept. E 179, Rochester, N. Y.

Sirs: Rush to me without charge—copy of 32-page book, "How to Get U. S. Government Jobs," with sample coaching, list of positions obtainable and full particulars telling how to get them.

Name.....

Address.....

SAVE YOUR MONEY! BE YOUR OWN SERVICE MAN



THE RADIO TROUBLE FINDER

Even the highest-priced radio set occasionally develops a fault and that at a time when you least expect it—maybe right in the middle of an interesting program. But, a handy copy of *The Radio Trouble Finder* is the simple means for tracing every defect and remedying it in the easiest manner possible. There is no mishap that could befall a radio, but what is fully covered in this valuable book.

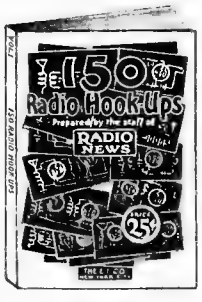
The Radio Trouble Finder is edited by men fully versed in the subject covered—men with years of actual experience behind them—and who have grown to prominence since the infancy of radio.

Don't wait till your set goes bad—get your copy of this remarkable guide to radio trouble now. Fill in the coupon and we will send you by return mail a copy of *The Radio Trouble Finder*, a money-saving investment. You can be your own service man.

The **25c** *Copy*

BUILD YOUR OWN RADIO SET

150 RADIO HOOK-UPS



This is the latest issue of this remarkable book. Absolutely new and up-to-date. All the best circuits of the day. Full instructions on how to build. Make your own set from the diagrams shown in *150 Radio Hook-Ups*. Write today—pick the set you want to build and make it. Then you are sure to be satisfied with the results you get.

150 Radio Hook-Ups was prepared by the staff of *Radio News*. An accurate guide to better set construction for the radio "fans."

The **25c** *Copy*

MAIL THIS COUPON NOW

CONSRAD CO., INC.
230 FIFTH AVENUE NEW YORK, N. Y.

CONSRAD COMPANY, INC.
230 Fifth Avenue, New York, N. Y.
Gentlemen:
Kindly send me a copy of 150 RADIO HOOK-UPS...THE RADIO TROUBLE FINDER..
(check which or both).
Enclosed find.....cents in full payment.

Name.....
Address.....
City.....State.....

Vote for Articles You Like

SCIENCE AND INVENTION is published for all science lovers, and in the interests of our readers it is only fair that the editors give them what they want. Heretofore, subjects which were judged to be of general interest were published, but now the reader can lend a helping hand in choosing the articles.

The object of this election is, therefore, to find out just what our readers like, what departments are to be shortened or dropped out, and what departments are to be retained or lengthened. In short, what our readers prefer. The Readers' Forum, while giving the reader an opportunity to state his views, is in this case, quite inadequate—mainly because of lack of space. Only a few letters could be published each month, whereas, with the individual ballot the majority of the readers can be heard from within a short time.

If you do not care to cut this copy, a letter or card bearing your choice of departments, articles and suggestions will be gratefully received. If you do not sign your name and are a woman reader, please indicate this by marking an X in the special box provided on the ballot. The editors wish this magazine to be of interest to all, and if our feminine readers are numerous, articles of appeal to them will be included in future issues.

Each ballot will be checked and counted and the results announced just as soon as a sufficient quantity has been received. The predilection of the majority will be respected. Articles or departments which meet with the general demand will be kept, others will be shortened or removed altogether. Vote now! and help us to make SCIENCE AND INVENTION a better magazine. A magazine which the whole family will read with profitable enjoyment. Use the editorial policy ballot and send it to the Editor, SCIENCE AND INVENTION, 230 Fifth Avenue, New York City, New York, U. S. A.

Readers Editorial Ballot

Editor, SCIENCE AND INVENTION:

I vote for changes to be made in editorial policy as indicated below. Suggestions and criticisms I have made on a separate sheet, which is enclosed herewith.

Kindly mark choice below and mail to Editor, SCIENCE AND INVENTION Magazine, 230 Fifth Avenue, New York City, New York (U. S. A.)

GENERAL ARTICLES

More	Less	
☐	☐	Agriculture
☐	☐	Astronomy
☐	☐	Automotive Articles
☐	☐	Aviation
☐	☐	Biology
☐	☐	Book Review
☐	☐	Botany
☐	☐	Editorial
☐	☐	Eposés
☐	☐	Geology
☐	☐	Home Movies
☐	☐	Latest Patents
☐	☐	Magic
☐	☐	Naval Advances
☐	☐	Patent Advice
☐	☐	Oracle
☐	☐	Phoney Inventions
☐	☐	Physics
☐	☐	Radio
☐	☐	Readers Forum
☐	☐	Scientific Fiction
☐	☐	Scientific Problems and Puzzles
☐	☐	Scientific Questions and Answers
☐	☐	Television

EXPERIMENTAL AND CONSTRUCTION ARTICLES

More	Less	
☐	☐	Constructor Department
☐	☐	Experimental Chemistry and Electrics
☐	☐	Hints for the Mechanic
☐	☐	How-to-Make-It
☐	☐	Model Department
☐	☐	Motor Hints
☐	☐	Radio Construction Articles
☐	☐	Radio Wrinkles
☐	☐	New Radio Services
☐	☐	Radio Oracle
☐	☐	Wood Turning
☐	☐	Home-Made Furniture
☐	☐	Wood-working—General
☐	☐	Wrinkles, Recipes and Formulas

The following subjects or new departments would also interest me greatly:

.....

.....

If you do not wish to sign, please place an X here if you are a woman reader ☐

(*Signed*).....

(*Address*).....

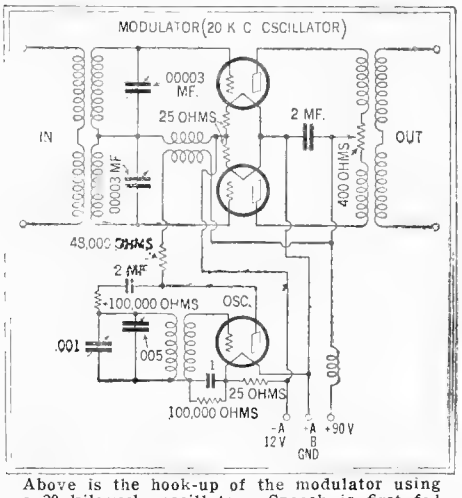
Secret Radio Telephony

(*Continued from page 245*)

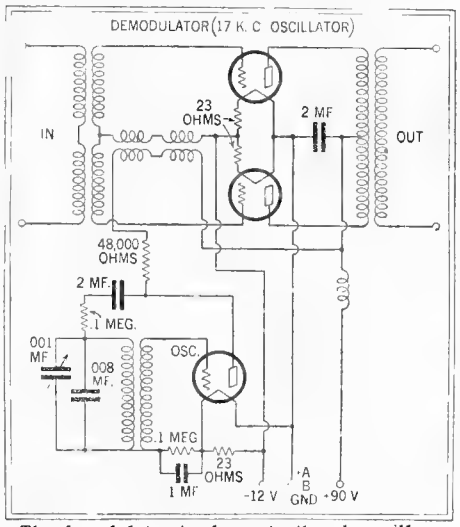
as the original speech band from 100 to 2,900 cycles, but is reversed or inverted. The following table will serve to give an idea of the inverting process, further illustrated on this page:

In Frequency	*Out Frequency*
100	2,900
1,500	1,500
2,500	500
2,900	100

With the development of this new apparatus, secret radio telephony seems practical and there is no reason why it should not be put to use in the near future. In order to make use of the inverted speech as a means for secret communication, both transmitter and receiver must be equipped with modulating and demodulating devices, such as those shown in the accompanying illustrations. The schematic diagrams of both the modulator and the demodulator, showing the hook-up now used, have been reproduced here. The synthetic speech which issues from the secert radio transmitter is wholly unintelligible to one listening over a receiver not equipped with the translating apparatus as illustrated at A. However, a receiver which has been equipped with modulator and demodulator will convert this gibberish to normal speech. While at present, the system for inverting speech has only been demonstrated, valuable inventions will follow.

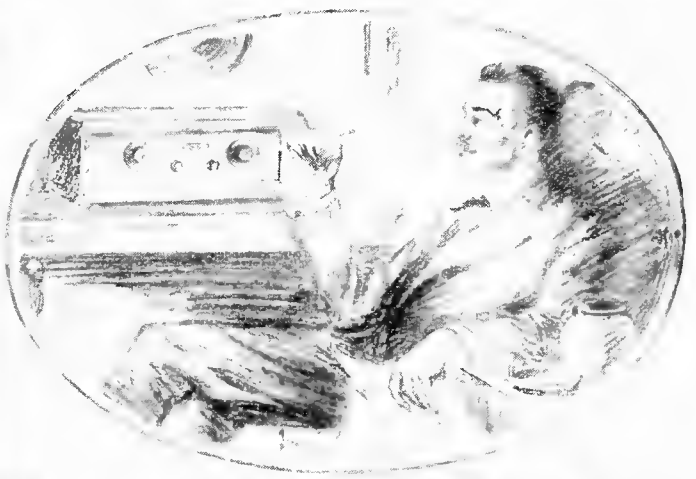


Above is the hook-up of the modulator using a 20 kilocycle oscillator. Speech is first fed into the modulator and then goes to the demodulator, the hook-up of which is shown below.



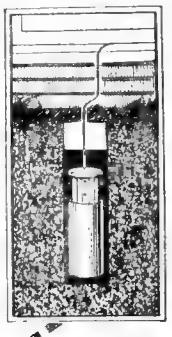
The demodulator is shown in the above illustration. Note that a 17 kilocycle oscillator is employed.

INSTALLED IN A FEW MINUTES



Ground Out Static with SUB-AERIAL

Let Ground Waves Bring You Amazing Distance, Crystal Clear Tone Quality, and Greater Volume and Selectivity without Distortion.



SUB-AERIAL has brought a new epoch in Radio. No need longer to bother with troublesome overhead Aerials. Why risk breaking your neck to put up roof aerials only to have the first storm blow them down? Forget your Acrial troubles. Why not use the whole earth as a static and noise filter with Sub-Aerial?

COSTS NO MORE THAN AN OVERHEAD OR LOOP AERIAL

and less than many. Hook your set on to the newly discovered Ground Waves that bring practically static-free reception. Don't stand for the squawks and tin-pan reception you get from Air Waves when you can step right out and *leave that stuff.*

If you don't believe us, try it yourself. If you do not find we're right—absolutely right—you don't pay us a cent for the test.

TRY IT FREE! We know so well the surprising results you'll get that we'll let you put in a Sub-Aerial entirely at our Risk. Don't take down your overhead Aerial. Pick a summer night when static and noise interference on your old Aerial are "Just Terrible." If Sub-Aerial doesn't Sell Itself to You Right Then on Performance—you needn't pay us a cent. Send for "all the Dope on Sub-Aerial." You'll be surprised. Do it NOW.

Underground Aerial Systems
St. Clair Bldg., Dept. 863-K.S.
Cor. St. Clair and Erie Sts.,
Chicago, Ill.
Mail Coupon NOW

UNDERGROUND AERIAL SYSTEMS, Dept. 863-K.S.,
St. Clair Bldg., cor. St. Clair and Erie Sts., Chicago, Ill.
Send me complete information on Sub-Aerial, Proof and Free Trial Offer. No obligation.

Name.....
Address.....
City..... State.....

MECHANICAL ENGINEERING

Learn at home

MECHANICAL Engineering embraces the design, construction and operation of machines and machine tools. It is a profession which offers almost unlimited opportunities to men who combine mechanical ability with technical training.

One of the best ways to train yourself to secure a position as a Mechanical Engineer is through the home-study courses of the International School of Engineering.

These courses are complete, up-to-date and especially arranged to meet the needs of the student who studies at home. They are particularly helpful because they are written by well-known mechanical engineers.

INTERNATIONAL SCHOOL OF ENGINEERING
Division of the International Correspondence Schools
Dept. 6240-E, Scranton, Penna.

Without cost or obligation, please send me full details of your home-study course in MECHANICAL ENGINEERING

Name.....
Address.....

Mail the Coupon for Free Booklet

Insure your copy reaching you each month. Subscribe to Science and Invention—$2.50 a year. Experimenter Publishing Co., 230 Fifth Avenue, N. Y. C.

ENLIST!

IN

America's First Independent Air Force

Organized to give America an independent civilian air organization, for the development of commercial, industrial, and civilian aeronautics. And to furnish the country with a self-supporting volunteer civilian reserve, that will be available for national defense, in time of need.

CIVILIAN DIVISION

Open to all who are interested in seeing America retain first place in the air.

SERVICE DIVISION

Open to American citizens, and to those who have filed their intentions of becoming citizens, between the ages of 16 and 45. This division includes both those who are already pilots or mechanics and those interested in qualifying as such.

Thorough training, as pilots or mechanics, will be offered to members of both divisions, at terms that will be available to all.

Members of the Service Division, only, agree to offer their services to the government, if war or national crises arise, during their enlistment.

NO FURTHER OBLIGATIONS OF ANY NATURE. All training, uniforms, or drills are entirely optional. They may be taken, or not, during the term of enlistment.

In keeping with our policy of real SERVICE to our members, we offer the following remarkable VALUES, upon the receipt of your enlistment fee:

ISSUE No. A-1 (With 3 Year Enlistment)

Our Ground School Text "MODERN AIR CRAFT," by Major Victor W. Page, containing over 350 pages and 500 illustrations, with fly-leaf bearing your name, the signatures of the commanding officers, and General Headquarters Seal, the U. S. V. A. S. solid gold wings same size as shown on coupon below; a gold embossed genuine leather Pass Case and your Identification Pass.

ISSUE No. C-1 (With 1 Year Enlistment)

Our Ground School Manual, "EVERYBODY'S AVIATION GUIDE," by the same author, with 250 pages, 140 illustrations, and 600 questions and answers on design, construction, and operation of all types of aircraft. This book includes the same individual fly-leaf. Same gold wings, Pass Case, and Identification Pass goes with this issue.

Other values to offer. Use coupon below, for immediate enlistment or as application for DESCRIPTIVE LITERATURE.

U. S. Volunteer Air Service
500 Fifth Av., New York City

☐ Enclosed find $5.00 for 3-year enlistment fee and Issue No. A-1.
☐ Enclosed find $2.00 for 1-year enlistment fee and Issue No. C-1.
☐ **Service Division.** **Civilian Division.**

Name. . . .

Age . . Address .

Are you an American citizen?.

PARKS

WOODWORKING MACHINES

Cabinet Shop Special No. 10

$290

with Motor

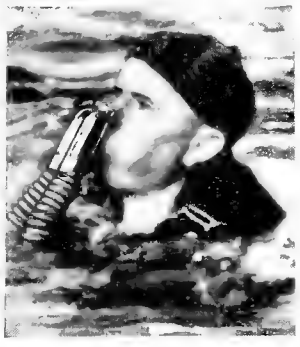
You ought to have this handy Parks in your shop. Compact, complete machine designed like a big production outfit at one-fifth the cost. Fits in a corner of your basement. Does any kind of cabinet and joinery work.

Write for circular

THE PARKS WOODWORKING MACHINE CO.
1553 Knowlton Street, Cincinnati, Ohio
Canadian Factory: 208 Notre Dame East, Montreal

NEW LIFE-SAVING DEVICES

At the left is a view of the new life-saving suit as it appears when worn. This is a German invention for saving those trapped in submarines.



At the right we see one of the suits being demonstrated. The suits are water-tight and buoyant and when the surface is reached, the breathing apparatus can be released.

A new life-saving device, which consists of a diving suit built upon an entirely new principle, has recently been invented in Germany. This was made in order to save the lives of those which were trapped in submarines. The suit is water-tight and buoyant. When the surface is reached, the breathing apparatus is released and the men can thus remain floating for a long time, until help arrives. Besides this, provision is made for a telephone buoy to be released from the craft, thus providing a means of communication.

When a submarine is disabled, a telephone buoy is released and pushed to the surface by compressed air. The above illustration shows the crew leaving a trapped submarine by means of a cable carried by the buoy.

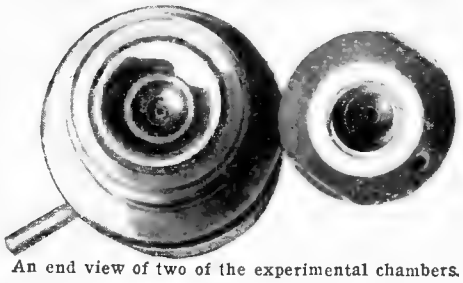
SYNTHETIC DIAMONDS NOW POSSIBLE

By LUCIEN FOURNIER

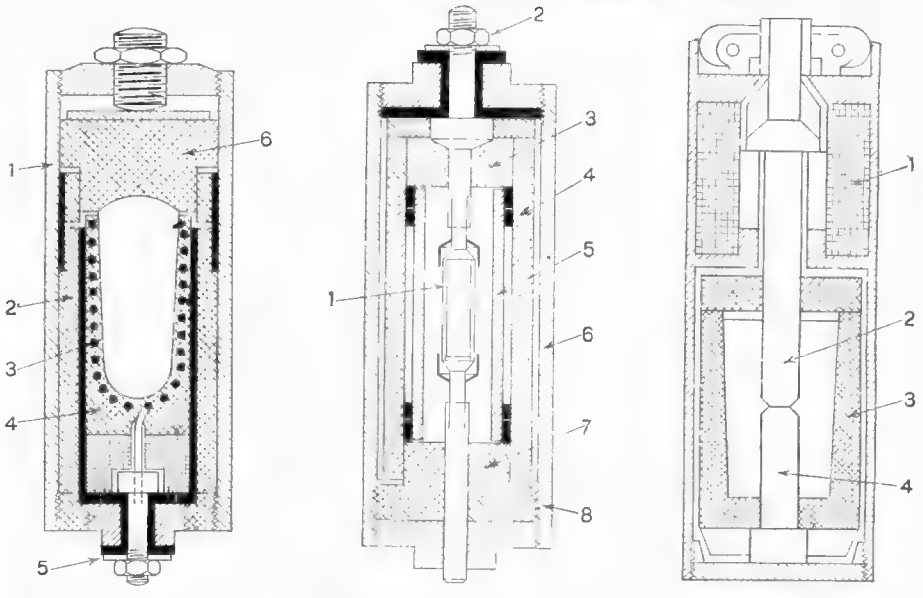
(Continued from page 215)

the synthesis of the diamond have already been the object of very exhaustive studies relative to the permanent production of ultra-pressures. The problem, in which all the scientists of the world are interested, seems to be the object of a particularly exhaustive study.

Perhaps the industrial diamond will come out of these experiments; but their interest centers above all in the many researches with ultra-pressures which Mr. James Basset proposes to undertake.



An end view of two of the experimental chambers.



Above, the drawing at the left shows at 1 the exterior tubing; 2 the heat insulation; 3, the heating coil; 4, crucible; 5, circuit terminal; and 6, refractory stopper. The center illustration shows the heating tube at 1; circuit terminal at 2; 3, refractory stopper; 4 and 5, refractory jackets; 6 and 8, exterior tubing; and 7, refractory stopper. The illustration at the extreme right shows resistance coil at 1; the electrodes at 2 and 4; and refractory crucible at 3.

Motor Hints

Conducted by GEORGE A. LUERS

(Continued from page 226)

In construction, these brackets consist of two lengths of wooden strips dressed, two by four inches. Each length is fitted with two curved rests to seat on the fenders. The left ends are fitted with two wedge shaped supports, in which the canoe is cradled.

Hooks are made up of strips of iron, three-sixteenth inch thick by one inch wide, the length being made to fit the curved edge of the fender.

One bracket is placed just forward of the radiator and the other just behind the body. Trunk straps are used to stay the canoe on the brackets.

Felt pads are used between the brackets and the fenders and also on the wedge shaped members, supporting the canoe.

AUTOMOBILE HEADLIGHTS

The necessary attention requires only a few minutes of time perhaps on two or three occasions each year. The headlights can be made to give good clear illumination, can be fixed against flickering of the lamp, and provision can be made for removal of the lamp rim for bulb renewals.

The attached sketch illustrates the simple details of care necessary for the prevention of headlight difficulties.

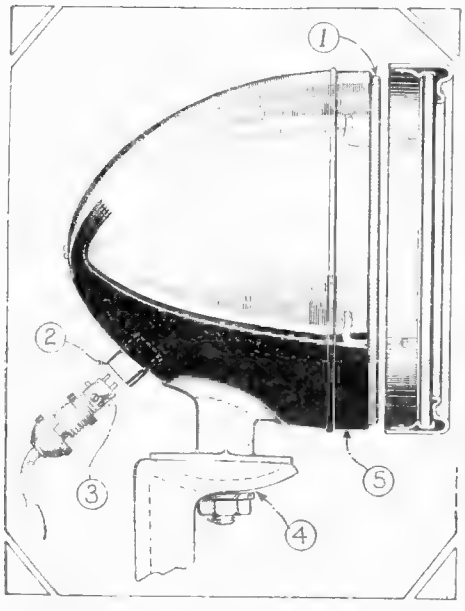
A light film of grease around the lamp rim allows of ready removal of this part. It prevents the rusted condition, which frequently necessitates breakage of the glass to remove the burned bulb.

A light film of grease on the rear lamp socket connection avoids corrosion of this terminal and also prevents entrance of moisture to tarnish the reflector.

The felt gasket between the glass reflector and case should not be allowed to drop out of position. Keep this in place to insure a seal at all times for the reflector. If the glass is broken, do not drive the car until the reflector is protected with a piece of heavy cardboard or similar arrangement.

The adjusting bolt in the lamp support should be drawn up tight at all times to prevent damaging vibration.

The terminal screws in the lamp connector should be tight. Grease these screws to prevent rusting and tighten two or three times each year.



Above 1, is a gasket to prevent reflector from tarnishing, 2, points to grease on lamp connection, 3, points to terminal screws which should be made tight, 4, shows lamp support which should be solid, and 5 indicates a grease film on rim seat.

WHOLESALE PRICES

New 1928 EDITION

FREE

This 148 Page RADIO CATALOG

FOR DEALERS, COMMUNITY SET BUILDERS GENERAL REPAIRMEN AND AGENTS.

BUY FROM RADIO'S OLDEST MAIL ORDER HOUSE

We are the oldest established, exclusive radio mail order house in the country. All orders are positively shipped within twenty-four hours; quick, prompt, courteous service. We carry a larger variety of radio parts, radio instruments, accessories and radio findings than any other radio house in the country.

You will find in Catalog No. 18 the largest assortment of radio merchandise in this country. Radio Specialty carries more radio parts and radio material than any other house in the country. You will find in this catalog positively the largest variety of radio merchandise.

If you are in need of certain small radio parts that other radio and mail order houses do not bother to carry get the Rasco Catalog and you will find the small parts there, anything from a screw to copper ribbon, telephone diaphragms, as well as thousands of ther small radio findings.

Be sure to get this great 148-page book with net prices.

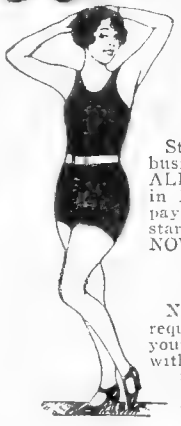
Radio Specialty Company is radio's oldest radio parts mail order house in the country, and the new confidential prices on standard radio merchandise are the lowest of any radio house.

We are ready now to appoint additional agents in all parts of the country. If you are contemplating making big money in radio merchandise, be sure to get in touch with us at once.

We carry the Largest Variety of Small Radio Parts in the world, BUT we also carry All Standard Radio Merchandise.

RADIO SPECIALTY CO., 100 PARK PLACE, NEW YORK

Let Us Start You in this Big-Paying Business



Step into a fine position—start your own business—or earn money in your spare time. ALL KINDS of golden opportunities for YOU in Photography. The work is FUN—and the pay is BIG. Our employment department has started hundreds on the road to success. RIGHT NOW there's a wonderful place for YOU.

WE FURNISH CAMERA AND TEACH YOU HOW

No previous experience, no special ability required. We teach you EVERYTHING in your spare time at home. CAMERA GIVEN with course. Your choice of Motion Picture or Still Camera. We also give instruction in our New York studios — the oldest, largest, best equipped school of Photography in the world

$50 TO $200 A WEEK— *FREE* BOOK TELLS

about the splendid openings in Motion Picture, Portrait, Commercial and News Photography. Mail coupon or write NOW.

N. Y. INSTITUTE OF PHOTOGRAPHY
Dept. 82, 10 West 33rd St., New York, N. Y

N. Y. Institute of Photography,
Dept. 82, 10 West 33rd Street,
New York, N. Y.

Yes, I'd like to know about the openings in Photography. Please send Book and Job Chart Free.

Name.....

Address.....

Town.....State.....

BUILD BUSINESS WITH AIR

Only $12 monthly for a few months brings best business builder your shop can have. Tire stores, Garages, Battery Shops, Filling Stations, are making BIG MONEY with new low-priced HB Automatic Air Compressor.

COSTS $75 TO $100 LESS

than similar equipment. Ask for bulletin S781—tells all about it.

Hobart Bros. Co., Box S781, Troy, O.

LARGE 48 PAGE BOOK free

STANDARDIZED Circular Service

Sell by Mail

Send For BOOK NOW

Mail Dealers!—Sell Books, Formulas, Novelties, Bargains! Our Ready Made Circular Service Saves You Money. *Large Profits!* Thirty Attractive Propositions. Popular Sellers. *Large Catalog "Sell by Mail" Free!*

F. A. ELFCO
519 So. Dearborn St. Chicago, Illinois

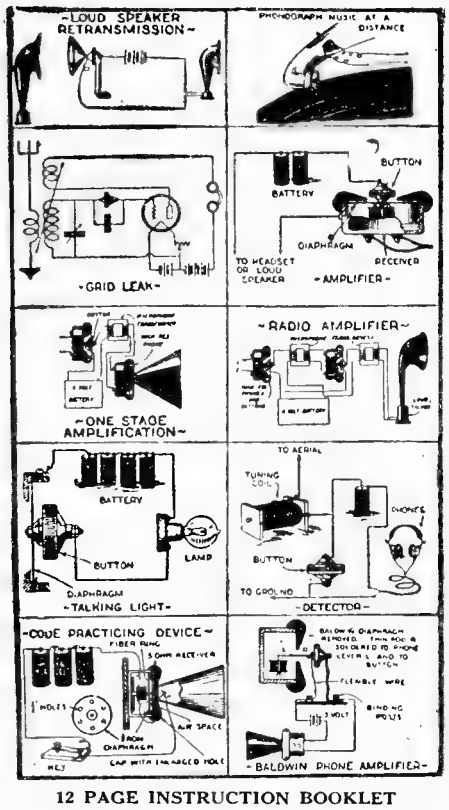
Insure your copy reaching you each month. Subscribe to Science and Invention—$2.50 a year. Experimenter Publishing Co., 230 Fifth Avenue, N. Y. C.

SKINDERVIKEN Transmitter Units

95c **Two for $1.75**

Have hundreds of uses. Every amateur should have two or three of these amplifiers in his laboratory.

A FEW USES FOR THESE UNITS



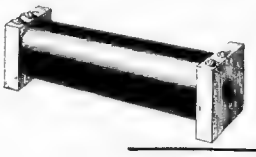
12 PAGE INSTRUCTION BOOKLET

containing suggestions and diagrams for innumerable uses, furnished with each unit.

WE PAY $5.00 IN CASH

for every new use developed for this unit and accepted and published by us.

P. G. MICROPHONE TRANSFORMER



A Modulation Transformer specially designed for use with the Skinderviken Transmitter Unit.

$2.

FOR SALE AT LEADING DEALERS

Or Order Direct, Using Coupon Below

SEND NO MONEY

When the postman delivers your order you pay him for whatever you have ordered, plus a few cents postage.

PRESS GUILD, INC. S-7-28
16-18-S—East 30th St., New York, N. Y.

Please mail me at once as many of the following items as I have indicated.

....Skinderviken Transmitter Units at 95c. for 1; $1.75 for 2; $2.50 for 3; $3.20 for 4.

....P. G. Microphone Transformers at $2.

When delivered I will pay the postman the cost of the items specified plus postage.

Name.....

Address.....

City..... ....State.....

OUR SPIRITUALISTIC INVESTIGATIONS

By JOSEPH H. KRAUS

(Continued from page 203)

26th, 1928, and as a challenge to you, that you, with all your trickery notwithstanding, are unable to produce any of the phenomena which I am able to produce under the strictest test conditions.

"The following are the terms of my challenge: You are to be tied lightly, that is, arms and legs to chair. I am to be tied with as much rope and as many knots as your committee may deem necessary, sealed, etc., and roped to chair. An honest and impartial committee must examine our bodies, clothing, etc., before being tied. We must BOTH be placed behind curtains previously examined by the impartial committee, and in FULL LIGHT I defy you to produce the phenomena which I shall produce.

"I am particularly desirous of impressing on you that this challenge has nothing whatever to do with any prize money offered by you, SCIENCE AND INVENTION *or any one else. This challenge is for the sole purpose of proving once and for all that I am neither a conscious nor a subconscious fraud; that the phenomena I produce are of a genuinely psychic nature; that they have nothing to do with trickery and that it is impossible for any one to duplicate, all conditions being the same, unless he or she be similarly psychically endowed as I am.*

"Copies of this letter are being sent to the press.

"I hope to receive your prompt reply."

Yours truly,
Nino Pecoraro.

To this he received the following reply:

"Your challenge to me to reproduce your so-called phenomenal experiments in spiritualism, is exceedingly humorous. Permit me to remind you that you have had two séances prepared for you, each extending over a period of approximately five hours, and in this combined period of time of ten hours, you have produced absolutely nothing that could not be duplicated by any six-year-old child, under similar so-called test conditions, as you presented them. In both instances, you promised to produce spirit forms, messages, and spirit wax hands, and after putting the committee to the trouble of preparing all of this for you, and inviting the ladies and gentlemen of the Press, you only succeeded in presenting an exhibition, which your own manager, of his own volition, proclaimed DISAPPOINTING AND DISGUSTING.

"I have already consented to duplicate the few little effects that you did present, such as pulling in the paper, dropping the pencil, etc., while you were apparently bound, and do not therefore think that in fairness to all concerned, you could expect committees to be arranged for you, and to sit through another ten hours on the strength of your promises, such as you have previously made, and FAILED UTTERLY to fulfill.

"IF YOU ARE A GENUINE MEDIUM AND CAN PRODUCE PHENOMENA, WHY DID YOU NOT DO SO DURING ANY OF THESE TESTS THAT HAVE ALREADY BEEN ARRANGED FOR YOU? YOU PROMISE EVERYTHING, AND PRODUCE PRACTICALLY NOTHING.

"I regret that you consider my judgment unfair. It is however strange that my judgment, that of the entire committee, the entire press representation, and your own manager, is unanimous."

Very truly yours,
JOSEPH DUNNINGER,
Chairman SCIENCE AND INVENTION
Committee for Psychical Investigation.

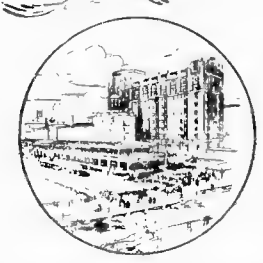
"DUNNINGER'S SEANCE" YIELDS RESULTS

IN order to demonstrate his ability to do things which no medium could do, and in order to show newspaper men how some mediums operate, Mr. Dunninger, chairman of the SCIENCE AND INVENTION Spiritualistic Committee, presented a number of seemingly supernatural phenomena strictly by scientific and natural means. As with Nino, leather gloves were sewed to Dunninger's shirt sleeves by news reporters, and his clothes were previously examined by another committee and found free of any possible piece of apparatus. The curtains had likewise undergone careful inspection by the same impartial group. Dunninger was tied to the chair, and the knots of the rope sealed. He was placed into his cabinet and within two minutes the phenomena commenced, not in the form of voice, but in the form of *actual manifestations.* In order to give you an idea of the setting, the following was done. Before entering the cabinet, two white cards, each bearing a signature of one of the press on either side thereof were tied together, after being found perfectly blank. After being tied, they were sealed; then they were put in a metal strong box and this box was tied and sealed, and placed 8 feet away from the front of the spirit cabinet. This metal strong box, by the way, was purchased by one of the editors, but a few minutes before the seance started. Two slates, each also bearing a signature of one of the press representatives were tied face to face and then sealed. Knots were tied in a double rope and a necklace of pearls was tied into the knots. The ends of the rope were then placed over the wire holding the cabinet drapes. *Here again the rope was tied and the knots sealed.* One of the members of the press was then requested to pick out any name in the telephone book, which in New York City contains approximately 610,400 names. The name chosen was Hyman, *and it was this name which was later found on the card.* A piece of paper with the names of four members of the committee was placed on the table. A can of paraffin and a can of water was likewise put in position. Modeling clay was placed 20 feet from the cabinet.

THE MANIFESTATIONS

THE manifestations in order were as follows. A star first appeared which moved out of the cabinet and fully 3 feet in front of it. Thereafter, the "spirit" of Houdini was actually materialized, and one of the photographs for this article shows that "spirit." A wax hand was produced, *with a wrist opening approximately three-quarters of an inch in diameter. An impression was found in the wax when it was examined by a committee. The ropes were untied and the endless necklace removed therefrom. The piece of paper was picked off the table and the name 'Houdini' was written thereon, when the lights were turned on again.* A message from Houdini:—"I still live, but only in the memory of the thousands I have mystified on earth—Harry Houdini," and a message from Rudolph Valentino appeared on the slates when they were opened by newspaper men. The seals were cut on the strong box, the box unlocked and the name Hyman appeared on the card. The wax on being examined, was found to contain the impression of two fingers, which were not those of Mr. Dunninger. When the spirit cabinet was opened, Dunninger was found in position with every knot still sealed. He used identically the same harness that was used by Nino Pecoraro and Mr. Davenport, his manager, who

The SEASIDE HOTEL



Atlantic City N.J.

To be free minded and cheerfully disposed at hours of meat and of sleep and of exercise is one of the best precepts for long lasting.

Francis Bacon 1625

Life's Secrets!

Amazing new book, **"Safe Counsel,"** just out, tells you the things you want to know straight from the shoulder. Gives advice to newly married. Explains anatomy of reproductive organs, impotence, laws of Sex-Life, mistakes to avoid, diseases, pregnancy, etc. Contains 9 startling sections: 1—Science o' Eugenics, 2—Love, 3—Marriage, 4—Childbirth, 5—Family Life, 6—Sexual Science, 7—Diseases and Disorders, 8—Health and Hygiene, 9—Story of Life. In all, 104 chapters, 77 illustrations, 512 pages. Examine at our risk. Mailed in a plain wrapper.

Send No Money

Write for your copy today. Don't send a cent. Pay postman only $1.98, plus postage, on arrival. Money refunded if not satisfactory.

FRANKLIN PUBLISHING CO.
Dept. 6102. 800 N. Clark St., Chicago, Ill.

DEAFNESS IS MISERY

Multitudes of persons with defective hearing and Head Noises enjoy conversation, go to Theatre and Church because they use Leonard Invisible Antiseptic Ear Drums. Tiny Megaphones fitting in the Ear entirely out of sight. No wires, batteries or head piece. They are Unseen Comforts and inexpensive. Write for booklet and sworn statement of the inventor who was himself deaf.

A. O. LEONARD, Inc., Suite 785 70 5th Ave., N. Y

LEARN CARTOONING

At Home—In Your Spare Time

The famous Picture Chart Method of teaching **original** drawing has opened the door of success for hundreds of beginners. Whether you think you have talent or not, send for sample chart to test your ability, and examples of the work of students earning from $50 to $300 per week. *Please state your age.*

THE LANDON SCHOOL
1460 National Bldg., Cleveland, O.

Free

Mailing Lists

Will help you increase sales. Send for FREE catalog giving counts and prices on thousands of classified names of your best prospective customers—National, State and Local—Individuals, Professions, Business Concerns.

99% Guaranteed by refund of 5¢ each

ROSS-Gould Co. 313 N. 10th St. St. Louis

Insure your copy reaching you each month. Subscribe to SCIENCE AND INVENTION—$2.50 a year. Experimenter Publishing Co., Inc., 230 Fifth Avenue, New York, N. Y.

was present at the second séance, *examined everything and proclaimed Dunninger to be a better "medium" than Nino Pecoraro.*

However, the editors know that all of Mr. Dunninger's effects were produced purely by scientific means, and have nothing whatever to do with spiritual phenomena. Mrs. Houdini proclaimed that the materialization of her late husband was the best that she had ever witnessed, and she assured the audience that Houdini's signature was reproduced in better style than she had ever previously witnessed it.

A SPIRIT HEAD?

SPIRITUALISTS will say that Mr. Dunninger is a medium; that he is afraid to admit it. As a further argument in their behalf, we would like to point out the enlargement of the head in the photograph showing the fluttering paper. Here on the curtain one sees a perfect likeness of a head.

This we wish to assure our readers is not a spirit; it is just a peculiar reflection of the flashlight on the curtains. The actual photograph shows several other forms beside this. Photographs of this nature are frequently used as evidence of the production of spirit forms. Sometimes as many as 75 or 100 pictures have to be taken before any result is obtained. Naturally in 75 to 100 pictures, some freak result should be obtained, which will give a likeness of the human face, even as the clouds shape themselves into grotesque forms and frequently resemble anything from horses to birds.

Up to the present time, the editors of this publication have not seen any spiritual manifestations which could be declared bonafide! Other mediums will undoubtedly try for the award and further announcements will be made. Heretofore most of those whom we have investigated did not produce phenomena of sufficient value to even merit the attention of our readers.

We do not question the honesty of the various mediums because they evidently operate in good faith. Whether consciously or subconsciously they are fraudulent, is the thing which must be judged at the termination of an investigation. There is no doubt but that many of them go into a genuine trance and in this trance they may not be accountable for what they do, nor is it always possible that the medium recollects what he or she did while under the influence of this self-inflicted trance state. The editors are perfectly agreeable to let any medium operate, without exercising any control over that medium whatever. Those statements to the effect that scientific observers impose all sorts of restrictions on mediums are purely figments of imagination or deliberate falsehoods. Science is just as determined in discovering the intricacies and whys and wherefores of spirit phenomena as it is in discovering the reasons for any other physical or chemical reaction.

EXPOSÉS of SCIENTIFIC SWINDLES

appear often in

Science and Invention

If you know of some hocus-pocus scheme being used to swindle the public—write the Editor about it.

LEARN RADIO and find

Good Pay from the Start, Rapid Advancement and Phenomenal Success in A Life Profession of Fascinating Brain-work.

You Can Learn At Home!

R. L. DUNCAN, Director, R. I. A.

Here is your big opportunity! Our graduates are earning big money as radio designers, as radio executives, in broadcasting work, as skilled service men and radio dealers. We have trained thousands to become successful radio operators on ships and in shore stations. And now opportunity is knocking at your door. *Are you going to plod along at a thirty-five dollar a week job when REAL MONEY is waiting for you in radio?*

A New Course

After years of experience, the Radio Institute of America has evolved a new and revolutionary course in radio—right up to the minute and abreast of the most recent developments in the radio industry.

It starts with the very fundamentals and takes you through every phase of radio—right through television, photoradiograms and airplane radio equipment.

The instruction is the work of radio experts, and its clearness and simplicity are such that you can master every point with ease. You take examinations—your papers are corrected and all your questions answered by men with years of radio experience.

A-1 Equipment

A large kit of first-quality equipment is included in the cost of the course—without extra charge—parts for making a hundred different radio circuits and the Peerless Signagraph and key and buzzer set for code instruction.

R. I. A. backed by RCA, G-E and Westinghouse

Conducted by RCA and enjoying the advantages of RCA's associates, General Electric and Westinghouse, the Radio Institute of America can and does give the finest radio instruction obtainable anywhere.

Home Study Course

Moreover, you can STUDY AT HOME—when you please and as long as you please.

This new booklet describing the course is now ready. If you want to learn more about the lucrative and fascinating profession of radio send the coupon now for your copy.

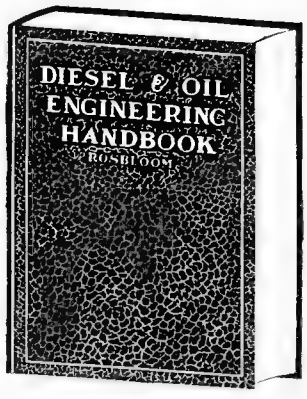
RADIO INSTITUTE OF AMERICA
Dept. G-7, 326 Broadway, New York City

RADIO INSTITUTE OF AMERICA
Dept. G-7 326 Broadway, New York City
Dear Mr. Duncan:
Please send me your new catalog I want to know more about your new radio course

Name .....
Address .....
City ..... State .....

DIESEL & OIL ENGINEERING HAND BOOK

(Rosbloom)



Fourth Enlarged Edition

The World's Standard Book on Diesel and Other Classes of Oil Engines

A remarkable book of greatest value to all engineers, mechanics, and others interested in Diesel engines for land, marine, locomotive, automobile, and aircraft use. Over 300 tables, hundreds of formulae, profusely illustrated with color and plain views. Courses of instruction on all leading types.

830 pages. Size 5 x 7 inches. Bound in flexible, semi-flexible and stiff covers of very attractive imitation leather with reinforced back.

Price $5.00 Prepaid

Order Direct from Book Department

EXPERIMENTER PUB. CO.

230 Fifth Avenue, New York

Book Review

PLANT AUTOGRAPHS AND THEIR REVELATIONS, by Sir Jagadis Chunder Bose. Stiff cloth covers, 5¼" x 8", illustrated, 230 pages. Published by The Macmillan Co., New York City. Price, $2.50.

This interesting work comes from the land of mystics, as we may term the Orient, and the author in his preface speaks of the nebulous boundary between the realms of the living and non-living. It is an elaborate study of the motions of plants. Some interesting illustrations show how curves or graphs are traced with adequate apparatus by these motions. One finds that the author's imagination serves him in excellent stead, for an unimaginative scientist is a very poor investigator. He studies the effects of wounds on plant motions and investigates motor paralysis in them, and through the pages plants and animals seem to be brought very close together. The book is nicely illustrated. One picture shows the Bose Institute, where Professor Bose has free rein given him for his investigations.

MOTOR VEHICLES AND THEIR ENGINES, by Edward S. Fraser and Ralph B. Jones. Leather covers, 5¾" x 9", profusely illustrated, 428 pages. Published by D. Van Nostrand Co., New York City. Price, $3.00.

Sometimes it would seem as if the day for books on the subjects of automobiles was nearly past, but this is far from true. The old "hit and miss" system of construction and operation has largely gone into the discard and turning over the pages of this book, one realizes how much exact science is involved in the modern motor vehicle. The Van Nostrand Publishing Company are doing good work in this field and this is only one of a number of valuable books which they have published on the subject. It is so full and so good that it cannot be reviewed within the limits of our space. And anyone who wants to be the intelligent and understanding owner and operator of a car will find this book of extreme interest. We especially would recommend as an illustration of the treatment, the description which it gives of starting systems, especially of the Bendix drive. The flexible cover suggests that it is for use.

AUTOMOBILE IDENTIFICATION, by Sergt. John Brennan. Leather covers, 5" x 7½", profusely illustrated, 174 pages. Published by Scientific American Publishing Co., New York City. Price, $2.50.

The identification of criminals by finger-prints is a well-known branch of study of the police detectives. In this little manual, automobiles come in for study, and the most elaborate series of identification marks of the many automobiles of the country are here put in shape for the use of the police. It seems that there is an auto school of police reserve, and a motorcycle school, and an aviation school in the city of New York, and the author of this book, Sergeant John F. Brennon is an instructor in automobile identification in these departments. The object of the book is to prevent the stealing of cars and, of course, to trace cars which have been used by criminals. The police pay attention, now, to brakes, so there is a short treatise on these. Finally, the traffic regulations for the city of Greater New York are given in detail.

ELEKTRISCHES FERNSEHEN FERNKINEMATOGRAPHIE UND BILDFERNUBERTRAGUNG, by W. Friedel. Stiff cloth covers, 6" x 8¾", profusely illustrated, 174 pages. Published by Verlag Von Hermann Meusser, Berlin, Germany.

The somewhat lengthy title of this book tells us that it is devoted to three principal subjects, electric television, the telecinema, and electrical transmission of pictures. These three subjects all come largely in the same line of work and curiously enough the last named one, it is fair to say, is the first one which has been satisfactorily solved. The transmission of pictures across the ocean or across the continent, New York to London, or San Francisco to New York, is now an accomplished fact and can be repeated at any time, but we have yet to wait for the time to come when we will see in the telephone booth the face of the person speaking to us. This book of nearly two hundred pages gives a very nice account of the present status of these allied arts, and it is done in a very clear way as regards the make-up of the book. The print and illustrations are worthy of the excellent treatment of the subject.

DAS NEUE UNIVERFUM. Stiff cloth covers, 6¼" x 9½", illustrated, 478 pages. Published by Union Deutsche Berlagsgeiellfchaft, Stuttgart, Germany. Price,

The best tribute we can pay to this familiar annual is to say that it is so good and complete that it hardly can be reviewed. It covers every subject of science, and this year appears to be more beautifully illustrated than ever. Those of our readers who are conversant with German will enjoy it extremely. Many familiar pictures will be found in it for it draws upon the world at large for its subjects. It has such an extraordinary collection of interesting material it can hardly be reviewed, and the profuse illustrations will enable even those not familiar with its language to enjoy turning over its pages.

AIRMEN AND AIRCRAFT, by Henry H. Arnold. Stiff cloth covers, 5¾" x 8¾", illustrated, 208 pages. Published by The Ronald Press Co., New York City. Price, $3.50.

This book covers balloons and airplanes and is made quite interesting, because it starts really with the history, or even with the mythology and legend of flying. It seems that as far back as 1742 an attempt was made to fly across the Seine River towards the Tuilleries. The early attempts are briefly treated. Perhaps more space could have been given to these chapters in the early history of the science. It was on December 17th, 1903, that the Wright brothers made four successful power driven flights in an airplane, and on that very day after the flights were ended a gust of wind overturned and wrecked the craft. An amusing incident of the early trials is that during the Wright's experiments, which were conducted in the early morning or late in the afternoon when there was the least wind, a man was observed to drive up to the scene and keep his wagon and horses by the roadside until the flights were completed and then he would shake his head and drive back to Dayton, the city identified with the Wright's invention. The man was an undertaker and it is said that his vehicle was a hearse. The book makes excellent reading, although not missing in technicalities, and it gives elaborate data in the appendices on nomenclature, on qualifications for flying and on the army and navy courses of instructions in the art.

AEROSTATICS, by Edward P. Warner, M.S. Stiff cloth covers, 5½" x 8½", illustrated, 108 pages. Published by The Ronald Press Co., New York City. Price, $3.25.

This book, too mathematical to lend itself to a review, falls into the Ronald Aeronautic Library, published in New York, and here we have the higher mathematics, applied to the lighter than air craft, which have only just begun to play their adequate part in aerial travel. The development has only begun; it is in its early stages and the future will bring out far different airships than the present.

THE RISE OF MODERN PHYSICS, by Henry Crew. Published by the Williams & Wilkins Co., Baltimore, U. S. A. The list price of the book is $5.00.

This 356-page volume presents the fascinating story of the discovery of natural laws. Twenty-five portraits of the greatest physicists are included, besides several line drawings, copied from the works of these scientists of the past. The book is written in twelve chapters and is well indexed. An idea of the contents is indicated by these chapter titles: Greek and Roman Science; Physics in the Middle Ages—Science in the Hands of the Clergy; Retraction, Dispersion and the Nature of Light; From Volta to Oersted; Electro-magnetism. This history of physics closes with a chapter on the rise of modern spectroscopy. Although this book is a popular sketch, the numerous quotations from the works of the famous scientists will appeal to the engineer and layman alike, as these scientists express themselves in simple words and in profound detail.

EVERYDAY ELECTRICITY, by Herbert T. Wade. Stiff cloth covers, 4¾" x 7¾", illustrated, 284 pages. Published by Little, Brown & Co., Boston, Mass. Price, $2.00.

This very popular little book not only gives a clear description of the elements of modern electricity in the practical sense but it also goes into construction, so that the reader will be enlightened as to setting up apparatus himself. As the major part of it relates to the commercial applications of the science, it cannot be considered, in any sense, a laboratory manual. A brief glossary and an index, unusually full for a book of this size, completes the work. It deals with motors, transformers, telegraphy, telephony, electric railroads and vacuum tubes.

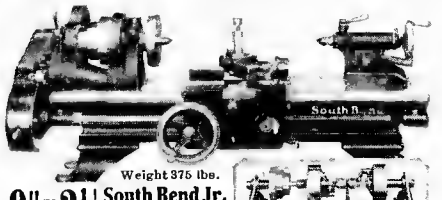
SPEED — LUXURY — LOW COST

The Quad Super Elto

4 Cylinder Outboard Motor

FINEST runabout performance is now yours at a fraction of usual costs! The Quad, sensational 4-cylinder portable outboard motor drives big, comfortable boats 25 miles an hour. Instant starting, utterly vibrationless, absolutely dependable. Drives racing craft at 35 miles and better. Send for book on Super Elto motors, also complete directory of outboard boats and builders.

ELTO OUTBOARD MOTOR COMPANY
Ole Evinrude, President
Mason Street Dept. 48, Milwaukee



Weight 375 lbs.

9" x 2½ South Bend Jr. LATHE

Back Geared Screw Cutting Precision Lathe *for the*

Tool Room
Manufacturing Plant
Machine Shop
Service Station
Electrical Shop
Laboratory
Engineering Shop

$150 Complete with Countershaft and Equipment

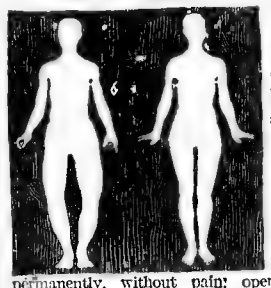
Easy Payments if Desired

Has Power feed to carriage, compound rest, ⅝-in. hole through spindle, phosphor bronze spindle bearings. Also made with floor legs and with 8, 8½, 4 and 4½ foot beds and with 3 types of motor drive. Costs less than 2c an hour to operate from lamp socket.

This Lathe Will
Cut Threads
Do Turning
Boring
Chucking
Make Bushings
True Commutators
Undercut Mica
Bore Connecting Rods
Finish Pistons
Reface Valves
and hundreds of other jobs

Write for Free Catalog 89A illustrating and pricing our complete line of 216 sizes and types.

South Bend Lathe Works 462 E. Madison St., South Bend, Ind. U.S.A.
New York City Salesroom, 183 Centre Street



PERSONAL Appearance

Is now more than ever the key note of success, both in social and business life. **Bow - Legged and Knock - Kneed men and women,** both young and old, will be glad to hear that my new appliance will successfully straighten, within a short time, bow-leggedness and knock-kneed legs, safely, quickly and permanently, without pain, operation or discomfort. Worn at night. My new "Lim Straitner", Model 18, U. S. Patent, is easy to adjust; its results will soon save you from further humiliation, and improve your personal appearance 100 per cent. (Model 18 is not like old-fashioned splints or braces, with bothersome straps, hard to adjust, but a scientific, modern device of proven merit, used and recommended for the last 7 years by physicians everywhere.)

Write today for particulars, testimonials, and my free copyrighted physiological and anatomical book, which tells you how to correct bow and knock-kneed legs without any obligation. Enclose a dime for postage.

M. TRILETY, Specialist 1656 L. W. U. Building, Binghamton, N. Y.

LET US SOLVE
THAT ELECTRICAL PROBLEM
IN APPLIED ELECTRICITY. Write for particulars.
THE ELECTRICAL SERVICE BUREAU
4735—159th Street Flushing, New York, N. Y.

It's All Bunk

By SAM BROWN

(*Continued from page* 205)

the beautiful mermaids of the sea. These mermaids of Grim's, it appears, only came to the surface of the water at the witching hour, and then they stayed but for a short time. But . . . the modern mermaid! How different! Eight hours a day. Seven days a week. Straight salary. No holidays. All day long she sits on a hard, hard rock, perfectly dry, while the audience, looking at our heroine through a water-filled glass tank which is directly in front of her, imagines that she is under water, and wonder vaguely how on earth any person could stay in such a position so long!

So it goes! Away back in the last century, Barnum put on exhibition the "Horse With His Tail Where His Head Should Be." It was a truthful statement. The exhibit was merely a horse standing in a stall with his tail in the feed-box instead of his head. People flocked to see the strange quadruped. That was eighty years ago. Last summer an enterprising carnival sideshow did a turn-away business with the same bit of "hooey!"

In fact, the list is endless. Occasionally a real freak flashes across the sideshow horizon, but the majority of these acts are pure bunk. Nevertheless, they are entertaining and amusing; they give the average spectator an intangible feeling of having seen something out of the ordinary. And that's a lot!

REAL DIVING ACT

AS an added feature, the majority of sideshows now carry their "free acts." These are the "ballyhoo" for the big show which follows. The performances are usually of the daredevil, eye-opener type; something to attract the crowd. And they do! Imagine a gasoline-soaked figure, afire, plunging downward eighty feet into a ten-foot tank of water! A real thriller! Not much bunk about it, either! An eighty-foot dive is no fun under any circumstances, and when you consider that the diver has only a light suit of asbestos and rubber to protect him from the flames, which is very little if he misses the tank—oh, well, it's a great life.

Readers Forum

(*Continued from page* 241)

As shown by Newton $V = \sqrt{\frac{e}{d}}$ Therefore, if Sir Oliver be right and Sir Ike's formula hold good, observe the deduction: Sound waves should travel much faster in ether than in air or water; yet, as a matter of cold fact, based on experimental evidence, sound waves will not travel at all in Sir Oliver's "ether-filled" vacuum(!)

Would it be heresy or sacrilege to suggest gently that, eminent though he be, he nevertheless is talking through his hat?

"People have invented a medium, the ether, for the express purpose of transmitting light-waves. But all we really know is that the waves are transmitted; the ether is purely hypothetical and does not really add anything to our knowledge."—*Bertrand Russell.*

A Bertrand for an Oliver!

RICHARD P. LOCKNER,
Philadelphia, Pa.

(Now what did we do to start all this? Will someone please come to the Editor's assistance. Might it be that this is all part of a publicity campaign for Bertrand Russel? If not, we must surely appreciate the views expounded by Mr. Lockner in his communication. He is a deep thinker and does not accept as fact all the hypothetical trash that one finds in some books.—EDITOR.)

In this . . FREE BOOK

a World-Famous Flier shows how *YOU* can get into

AVIATION

WALTER HINTON

Trail-blazer, pioneer, explorer, author, instructor. AVIATOR. The first man to pilot a plane across the Atlantic — the famous NC-4—and first to fly from North to South America. First, too, to explore the jungle fastnesses of the upper Amazon. The man who was a crack flying instructor for the Navy during the War; who today is training far-sighted men for Aviation. Hinton is ready to back YOU up to the limit. His Book is yours FREE for the coupon below.

HERE is the book that tells exactly what Aviation offers YOU. Walter Hinton—hero of history-making flights—gives you the brass tacks of Aviation Today. He shows you exactly *where* your opportunities lie—exactly *how* to fit yourself for them. Here is a book for men with too much backbone to stay chained to a sma'l-pay job—too much adventure in their blood for a humdrum grind—too much good sound business sense to let this opportunity of a lifetime outgrow them!

THE RICHEST, FASTEST GROWING INDUSTRY THE WORLD HAS EVER KNOWN

Cities everywhere are building more airports; 24-hour shifts are racing construction on new plane and equipment plants. Air lines, air service of every kind is doubling and re-doubling itself almost while you watch! There's no doubt about there being BIG PAY plus a *real future* for YOU in Aviation. Your one sure move is to get the *right training*—QUICK!

AVIATION IS READY—HINTON IS READY NOW IT'S UP TO YOU

Hinton will train *you* for Aviation, right at home in spare-time. His proved course teaches *all* about plane construction, rigging, repairs, motors, instruments, theory of flight, navigation, commercial Aviation. Whether you plan to fly, or want one of the *forty* Big Pay ground jobs, you *must* have this ground-work first. Hinton's Free Book tells you how to start. Clip the coupon and send it TODAY!

AVIATION INSTITUTE OF U. S. A.
WALTER HINTON, *President*
1115 Connecticut Avenue Washington, D. C.

Mail Now for Facts

WALTER HINTON, Pres., 4-G
Aviation Institute of U. S. A.,
1115 Connecticut Ave., Washington, D. C.
Send me your FREE Book telling how I can train under you right at home for Aviation

Name .....
Street ..... *Age*
City ..... *State* ...

INVENTORS

Protect Your Ideas

Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for INSPECTION and INSTRUCTIONS FREE. TERMS REASONABLE. BEST REFERENCES.

RANDOLPH & CO.
Dept. 172, Washington, D. C.

Name.....

Street.....

City.....

A Personal Service for
INVENTORS

I maintain an unexcelled organization and thoroughly equipped laboratories, to render the following services.

I PREPARE APPLICATIONS for patents for filing in the United States and foreign countries.

I PLACE INVENTIONS with responsible manufacturers, with whom I am acquainted, under arrangements that are made profitable to the inventor.

I SPECIALIZE in Electrical, Mechanical, Chemical, and Radio Devices.

I INVITE CORRESPONDENCE with reputable inventors, Scientists, Chemists and Physicists, regarding their inventions and uncompleted experiments.

H. R. VAN DEVENTER
Licensed Professional Engineer
Registered Patent Attorney
342 Madison Avenue, New York City

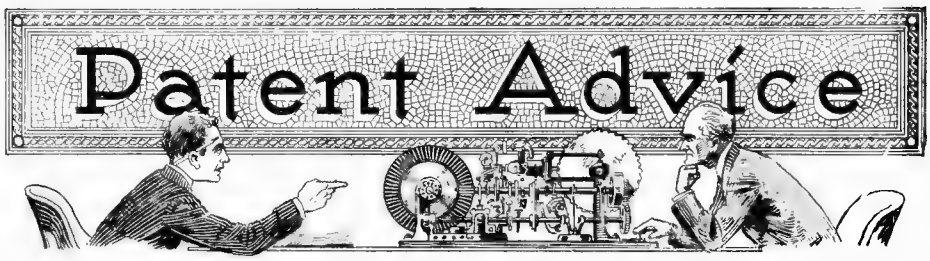
PATENTS

BOOKLET FREE **HIGHEST REFERENCES**
PROMPTNESS ASSURED **BEST RESULTS**
Send drawing or model for examination and advice.
WATSON E. COLEMAN, Patent Lawyer
724 9th Street, N. W., Washington, D. C.

INVENTIONS Commercialized
TURN INVENTIONS INTO CASH
ON A CASH OR ROYALTY BASIS
PATENTED or UNPATENTED
In Business 25 Years - Complete Facilities - References.
Write **ADAM FISHER MFG. CO.,**
205D Enright Ave. St. Louis, Mo.

EDGAR M. KITCHIN
Attorney and Counsellor at Law
Patent and Trade Mark Specialist
805 G. Street, N. W. Washington, D. C.

BLUE BOOK ON PATENTS
and Priority Record blank gratis.
MONROE E. MILLER, PATENT LAWYER,
411-6 Ouray Building, WASHINGTON, D. C.
ELECTRICAL AND MECHANICAL EXPERT



CONDUCTED BY JOSEPH H. KRAUS

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches, and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

COLORED LICENSE PLATES

(1097) E. M. Perry, Cincinnati, Ohio, suggests an idea for making new styles of automobile license plates, in which various insignias such as crosses, triangles, etc., of different colors would appear on the plate proper. The plates themselves are likewise to be of various colors. He requests our opinion.

A. 1. The suggestion which you advance for automobile license plates is of little consequence. In a city like New York there would be thousands of different colors and differentiation between the various shades would be difficult, while the cost of plates would also be greater. It would be hard to tell the difference between a plate for one year and a plate of the next year. Coincidentally, the color-blind people would find it difficult to make out the colors of all the insignias. The number system is, in our opinion, by far the best.

SUBMARINE DEVICE

(1098) Anthony Caruso, Fort Lee, N. J., asks some general questions concerning the saving of men entrapped in submarines by a mechanism, the nature of which is not made clear in his query.

A. 1. The chances are that any invention for saving men entrapped in a submarine will not meet with a market, why then go to the trouble and expense of patenting such an idea? There are today several thousand systems which are supposed to be practical. It is safe to say that not one of them will ever be put into actual practice, and every one of the inventors will have a patent, with which he can do nothing. Unless you are non-appreciative of financial reimbursement, we suggest no further action.

AIRPLANE GAS CONTROL

(1099) Robert L. Chase, Somerville, Mass., requests our opinion of a gas control, placed directly on the joy-stick of an airplane.

A. 1. Perhaps your idea for an airplane control would be more suitable than the one now in use, but we see no purpose for it. It is just as easy to have the gas control on the dashboard because that control is not constantly being manipulated. In your present type, the slight movement of the hand in either direction may be the means of stopping the airplane or causing it to speed up rapidly, even when such a speed is not desired. An airplane continues to run along at a fairly constant speed over long stretches of time, and the control is no more necessary than in the case of an automobile on some motor parkway or beach where, after the throttle is once opened, it can remain there until the time comes to stop the engine.

We hold that a patent on such an article would be of no financial benefit to you.

THE "INVENTIONS PURCHASED" CONCERNS

(1100) Howard B. Van de Water, Baldwin, L. I., asks whether the business of various concerns who advertise that they purchase inventions or sell them for the inventor is legitimate. He wants to know why it is that they requested a fee for listing his invention. He also asks several other questions made clear in the answer.

A. 1. There are quite a number of concerns in the United States that advertise inventions for sale, and then if some inventor who reads their literature decides that he is going to place the matter in their hands, he receives a letter asking for a check for $20.00 or $25.00. This money goes to pay first, the cost of advertising of that invention in various newspapers and periodicals, second, the cost of overhead for the firm; third, the salaries of the members of that firm; and secretarial expenses.

But the business is perfectly legitimate. These companies usually do not take out a patent for the inventor unless there seems to be a positive assurance of sale. They do not even like to handle unpatented articles because there is no guarantee that such unpatented articles can be effectively sold.

If you have an article that is worth while patenting, by all means secure such a patent. If it is not worth while, why spend money to advertise its sale.

BOTTLE CAP

(1101) John S. Oberg, Sacramento, Calif., has designed a cap for bottles which is removed by tearing it from the bottle. He asks our opinion on the suggestion.

A. 1. We do not see that the bottle cap advanced by you is any material improvement over bottle caps now on the market. It is even doubtful if you could protect the idea.

There are breakable bottle caps on the market today fitted with a finger and grooved clear across, so as to permit complete breakage and easy removal. Your groove extends but halfway across or a little more. A second groove is so arranged that one can tear the cap. There is really no necessity for the second groove if the plate rests against the side of the bottle as you indicated.

While there is always room for a new type of bottle cap, it should be as simple as others and much more so than the one indicated by you; it should be easily applied and capable of being quickly and perfectly removed with the exertion of but little strength. There is also room on the market today for a bottle cap which can be removed and replaced, but which must fit very tightly. We would not consider the particular device you have made worth the expense of application for patenting.

CONFIDENTIAL?

(1102) Eugene F. Peltola, Rugby, N. D., asks whether he should patent a typewriter attachment, producing horizontal and vertical lines, and also whether he should protect an alarm clock with a variable volume of the awakening sound signal. He also asks a question concerning whether our reports are confidential.

A. 1. There is nothing new or remarkable in your suggestion for making vertical or horizontal lines with the aid of an attachment for a typewriter. Attempts to do this have been numerous but none of them has met with a successful market. A patent search will reveal many existing devices, covering this same subject.

Neither do we suggest any further action along the line of an alarm clock in which the intensity of the sound can be varied. This principle is not new.

Science and Invention Magazine holds these communications absolutely confidential, which are accompanied by the usual fee for answering questions by mail. All other letters may be answered in the pages of this publication, but we always protect the inventor as much as possible, if in either case we consider his idea is of value.

PATENTS

At the right is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ.

My Patent Law Offices Just Across Street From U.S. Pat. Office

All drawings and specifications are prepared under my personal supervision.

Protect Your Ideas

Take the First Step Today—Action Counts

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

Prompt, Careful, Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

Strict Secrecy Preserved—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.

No Charge for Information On How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Clarence A. O'Brien

Registered Patent Attorney

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims.

PRACTICE CONFINED EXCLUSIVELY TO PATENTS, TRADEMARKS AND COPYRIGHTS

Inventors *Write for these* Free Books

Mail this Coupon *Now*

CLARENCE A. O'BRIEN
Registered Patent Attorney
539 Security Savings & Commercial Bank Bldg., Washington, D. C.

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name .....

Address .....

.....

(Important: Print or Write name clearly)

PATENTS

TRADE-MARKS—DESIGNS
FOREIGN PATENTS

MUNN & CO.
PATENT ATTORNEYS

Associated since 1846 with the Scientific American

SCIENTIFIC AMERICAN BUILDING
24 West 40th Street
New York City

SCIENTIFIC AMERICAN BUILDING
Washington, D. C.

TOWER BUILDING
Chicago, Ill.

HOBART BUILDING
San Francisco, Cal.

VAN NUYS BUILDING
Los Angeles, Cal.

Books and Information on Patents and Trade-Marks By Request

Associates in all Foreign Countries

PATENTS

DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form, "EVIDENCE OF CONCEPTION," to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. The form, "Evidence of Conception," sample, instructions relating to obtaining of patents, and schedule of fees sent upon request.

LANCASTER & ALLWINE
255 Ouray Bldg., Washington, D. C.
Originators of forms "Evidence of Conception"

1000 NEEDED INVENTIONS

Here is the most remarkable book ever offered to inventors. One Thousand needed inventions listed and described. Arranged as follows: General Problems; Automotive; Mechanical; Electrical; Chemical; Radio; Marine. Separate chapter on the Ten Most Needed Inventions. This book may give you one idea that will win you a fortune. Nothing else like it has ever been published. Compiled at enormous expense. Edited by Raymond Francis Yates, formerly Managing Editor of a leading scientific magazine. Over 100 pages, durably bound.

Send No Money

Cut out this advertisement and send it to us with your name and address plainly written and your copy of this remarkable book will be sent immediately. Pay the postman only $1.25, plus postage, on arrival. Money back after 10 days' examination, if desired. Limited edition. Write NOW. (Outside U. S. $1.45 cash with order.)

BUREAU OF INVENTIVE SCIENCE
Dept. 77 Rochester, New York

NEW YEAR - NEW IDEA
PATENT YOUR IDEAS
Call or send me a sketch of your invention. Phone LONgacre 3088
FREE Inventors Recording Blank Confidential Advice
U. S. and Foreign Patents secured by
Z. H. POLACHEK Reg. Patent Attorney Consult Engineer
1234 Broadway, New York

MACHINE SHOP
FOR GENERAL AND EXPERIMENTAL WORK

Expert Mechanician in Electrical and Machine Work of all Kinds. Models, Light Manufacturing. Established since 1878. Paul Hoenack, 108 Park Row, near Chambers Street, New York City. If it's mechanical, we make it.

WE COMMERCIALIZE INVENTIONS

Communicate with us if you have a patent to sell or wish to buy one.

North American Finance & Development Corp.
915-15th St., N. W., Washington, D. C.

The Strangest of All Laws

By UTHAI VINCENT WILCOX

(*Continued from page 213*)

terest and talked business or money. They further seemed to talk to women considerably about themselves—at least to the extent of 17 per cent, which was even more than they talked about themselves to other men.

It is evident that the various occupations of the individuals concerned would have a bearing on any useful deductions. These scientists classified the social status of those listed, but the results on the whole showed less change than might be expected. The business people talked about business and money in 70 per cent of the cases, and the industrial workers in 43 per cent. In each case business easily led all other interests listed.

Alert business men who are, in their own sphere, practical psychologists, have found in the results of those investigations an opportunity to profit, also in some cases a vindication of methods of approach. They know, as any popular hostess knows instinctively, that subject for talk—topics of conversation—are matters of habit. However, they are, as well, focal points of fundamental interest in turning conversation into profitable channels.

We may instance a man who receives annually a salary that might well be the envy of a whole group of congressmen. He has noted in a small book for a period of years, his most successful methods of approaches as they relate to conversation—talk. By tabulating these he has worked out a system that by the general law of averages is sure to bring him a large measure of success. He adds to this his own shrewd knowledge of how to turn the topic of first expressed interest to that of ultimate, financial interest.

There is, likewise, a women who has become very successful in collecting money for worthy charitable purposes. She comes in contact with both men and women. By such studies as she has done in recognizing chief topics of general and specific interest similar to the results of the Ohio psychologists she has been able to surpass all of her associates in adroitness of approach, which, she says, is nothing more than a flavoring of tact added to the law of conversational averages.

Deep-Sea Motion Picture Camera

By H. WINFIELD SECOR

(*Continued from page 206*)

upon the ground glass. The usual type of shutter is found down at the bottom of the mechanism, which it is not necessary here to describe.

In the scene here illustrated, a large imitation octopus has apparently coiled two of its arms about a fair diving beauty who, unfortunately, got too close to this deep-sea denizen. Of course, we must have the usual hero rushing to the scene of the rescue, which he conveniently does in a diver's suit. Presently the gun will send its bullet into the monster's body, which in keeping with the facts, will slowly uncurl and at the same time exude a mass of inky black fluid.

PATENTS

To The Man With An Idea

Patents Procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request.

IRVING L. McCATHRAN
Patent Lawyer
Formerly with and Successor to Richard B. Owen
202 Owen Building, Washington, D. C.
419 Park Row, New York City

TRADE-MARKS REGISTERED

Automatic Concertina
(Small Size Piano Accordeon)
PLAYED WITH INTERCHANGEABLE ROLLS

Without any faint idea of music or notes, without any study or practice, you can play perfect, like an artist, any songs, dances, fox-trots, one-steps, operas, marches, etc. Nobody can see the mechanical arrangement, everybody must think you are an artist. Wonderful tone, playing complete with all bass and accompaniments. Music is wanted and welcomed everywhere. Biggest assortment of rolls, latest hits. Three models. College model, $30.00; Home model, $45.00; Concert model, $60.00, and music rolls free. Descriptive circular No. 8 mailed free.

TREASURE SALES COMPANY, 1690 Boston Rd., NEW YORK, N. Y.

Learn to PAINT SIGNS and SHOW CARDS

We quickly teach you by mail, or at school, in spare time. Enormous demand. Big future. Interesting work. Oldest and foremost school.

EARN $50 TO $200 WEEKLY

John Vassos, N. Y., gets $25 for single show card. Crawford, B. C., writes: "Earned $200 while taking course." Don't delay. Send today for complete information, samples and guarantee.

DETROIT SCHOOL OF LETTERING
179 Stimson Ave. Est. 1899. DETROIT, MICH.

PATENTS

As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well-known Patents of extraordinary value. Book, Patent-Sense, free.

Lacey & Lacey, 644 F St., Washington, D. C. Estab. 1869

BE AN OIL EXPERT!

Trained men needed! Geologists, Drillers, Refiners (Chemists and Still Men), Oil Salesmen, earn 2 to 10 times more than in other fields. Write today! FREE Booklett Petroleum Engineering University, Dept. 267, Fort Wayne, Ind.

TRAVEL for "Uncle Sam"

New Bandit Proof Railway Mail Car

U. S. Government Jobs
$1,700 TO $3,000 YEAR

Men, Boys, 18 Up

Steady Work
Paid Vacations
Common education usually sufficient

Franklin Institute
Dept. E 184, Rochester, N. Y.

COUPON

Gentlemen: Rush to me without charge 32-page book with list of U.S. Govt big paid positions obtainable and sample coaching. Send full information telling how to get a position.

Mail coupon immediately.

Name.....
Address.....

Insure your copy reaching you each month. Subscribe to SCIENCE AND INVENTION—$2.50 a year. Experimenter Publishing Co., Inc., 230 Fifth Avenue, New York City.

The Metal Emperor

By A. MERRITT

(*Continued from page 225*)

"It is done," she said, "And it was well done. Now you and I shall dwell together in the peace—beloved. Or if there be those in the world from which you came that you would have slain, then you and I will go forth with our companies and stamp them out—even as I did these."

My heart stopped beating—for from the depths of Ruth's eyes shining shadows were rising, wraiths answering Norhala's calling. And, as they rose, steadily they drew life from the clear radiance summoning them—drew closer to the semblance of that spirit which Norhala's vengeance had banished, but that had now returned to its twin thrones in Norhala's eyes.

And at last it was twin sister of Norhala who looked from the face of Ruth!

"Sister," she whispered. "Little sister. These men you shall have as long as it pleases you—to do with as you will. Or if it is your wish they shall go back to their world, and I will guard them to its gates. But you and I, little sister, we will dwell together—in the peace. Shall it not be so?"

With no faltering, with no glance toward us three—lover, brother, old friend—Ruth crept closer to her, rested her head upon Norhala's breast.

"It shall be so," she murmured. "Sister—it shall be so. Norhala—I am tired. Norhala—I have seen enough of men!"

An ecstasy of tenderness, a flame of unearthly rapture, trembled over the woman's face.

"Ruth!" cried Drake—and sprang toward them. She paid no heed, and even as he leaped he was caught and whirled back against us.

"Wait," said Ventnor, and caught him by the arm as he strove against the force that held him. "Wait! No use—now."

There was a curious understanding in his voice—a curious sympathy, too, in the patient gaze that dwelt upon his sister and the woman who held her.

"Wait!" exclaimed Drake. "Wait—when the damned witch is stealing her away from us!"

Again he threw himself forward, recoiled as though swept back by an arm, fell against us and was clasped and held by Ventnor. And as he struggled the Thing we rode halted. Back into it like metal waves rushed the billows that had washed over the fragments of the city. We were lifted. We rode high. Between us and the woman and girl a cleft appeared. It widened into a rift. It was as though Norhala had decreed it as a symbol of this her second victory. Had set it between us as a barrier.

Wider grew the rift. Except for the bridge of our voices, it separated us from Ruth as though we had stood upon another world. Higher we rose. The three of us now upon the flat top of a tower upon whose counterpart, fifty feet away and facing the homeward path, Ruth and Norhala stood with white arms interlaced.

The serpent shape flashed toward us. It vanished beneath, merging into that which bore us.

Then, slowly, we began to move. We glided to the chasm blasted in the cliff wall. The shadow of those walls fell upon us. As one we looked back. As one we searched out the patch of blue with the black blot at its breast.

We found it—then the precipices hid it.

We streamed through the chasm, through the cañon and the tunnels—speaking no

PATENTS TRADE-MARKS AND COPYRIGHTS

OUR OFFER: FOR THE PROTECTION OF YOUR INVENTION

YOUR FIRST STEP. The inventor should write for our blank form—"RECORD OF INVENTION." This should be signed, witnessed, and returned to us, together with model or sketch and description of the invention for INSPECTION and ADVICE FREE!

Our FIVE Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents, Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE-MARK BOOK

Shows value and necessity of Trade-Mark Protection. Information regarding *Trade-Marks and unfair competition in trade;*

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries and secure Foreign Patents in shortest time and at lowest cost.

PROGRESS OF INVENTION

Description of World's Most Pressing Problems by Leading Scientists and Inventors

All Communications and Data Strictly Confidential. Interference and Infringement Suits Prosecuted.

IMPORTANT

TO AVOID DELAY MAKE YOUR CASE SPECIAL. YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to save correspondence, secure protection and early filing date in the Patent Office. To secure special preparation of your case send $25.00 on account with model or sketch and description of your invention.

Our Lawyers Practice in all U. S. Courts and defend Clients in Suits involving Patents, Trade-Marks and Copyrights

OUR ORGANIZATION OFFERS PERSONAL SERVICE

By Experienced Patent Lawyers, Solicitors, and Draftsmen

We regard a satisfied client as our best advertisement, and furnish, upon request, lists of clients in any state for whom we have secured patents.

Highest References—Prompt Service—Reasonable Terms

WRITE TODAY

FREE COUPON

VICTOR J. EVANS & CO.

Registered Patent Attorneys

MAIN OFFICES: 715 Ninth St., Washington, D. C.

BRANCH OFFICES: 1007 Woolworth Bldg., New York City; 518-519 Liberty Bldg., Philadelphia, Pa.; 514 Empire Bldg., Pittsburgh, Pa.; 1114 Tacoma Bldg., Chicago, Ill.; 1010 Hobart Bldg., San Francisco, Calif.

Gentlemen: Please send me FREE OF CHARGE your books as described above

Name. . . . . .

Address. . . . . .

8 POPULAR MODERN MOVIE NOVELS $1.00

GREATEST OFFER EVER MADE

Take Advantage of This Amazing Bargain

Eight full size books for one dollar. Never before has an offer of this kind been made. Only quantity production permits us to make this astounding offer now. Take advantage of it while you have the opportunity. Needless to say these modern up-to-date movie hits cannot last long at this tremendous bargain price. Each book contains at least two color "stills" of an actual scene from the photoplay. Don't hesitate. Mail this coupon now. Every story based on an actual moving picture triumph. The greatest book bargain of the age.

Titles of This Tremendous Bargain Offer

1. New York
2. The Campus Flirt
3. Almost a Lady
10. Sensation Seekers
11. The Rambling Rangers
12. Don't Tell the Wife
14. Tracked by the Police
15. Tell It to the Marines
19. Irresistible Lovers
20. The Cohens and Kellys In Paris
21. The Divine Woman
22. Jazz Mad
23. The Crimson City
24. You Can't Beat the Law
25. Tillie's Punctured Romance
26. Forbidden Hours

8 BOOKS FOR $1.00
Your Choice

An Addition To Your Library

These books will be a worthwhile addition to your library. You will find many hours of truly enjoyable reading in each beautiful volume. Printed on fine paper with large clear type. Beautiful colored covers of flexible durable material. These books are undoubtedly one of the greatest values ever offered at this amazingly low price.

Write Now! Don't Wait! This bargain cannot last long at this price.

CONSRAD COMPANY, INC.
230 FIFTH AVENUE NEW YORK, N. Y.

CONSRAD COMPANY, INC., 230 Fifth Avenue, New York, N. Y.
Gentlemen. Enclosed find $1.00. Kindly send me the books listed by number herewith:

Numbers. . . . . .
Name . . . . . .
Address . . . . . .
City. . . . . State. . . . . .

Don't Envy the Plumber

BE ONE

$11.00-$16.00 PER DAY and work EVERY day, is the Plumber's wage.

Every skilled workman will tell you that Plumbers have the best of it. WINTER and SUMMER the Plumber is busy at top wages. No skilled Plumber is ever out of a job—compare his opportunities with any trade, plus the opportunities of having your own shop.
We teach you Plumbing with TOOLS (not books) under Licensed Master PLUMBERS in one of the finest equipped schools in America. We make you a Plumber, every branch is taught thoroughly—Lead Work—Blue Print for plan reading—all other tricks.

LEARN IN 8 TO 12 WEEKS without previous experience
If you are making less than $60.00 a week you owe it to yourself to investigate. Get FREE catalog that tells in pictures and words how we teach this trade. Special dates now.

UNIVERSAL PLUMBING SCHOOL
2057 Troost Ave. KANSAS CITY, MO.

500 TRICKS—10C.

BE POPULAR—LEARN TO ENTERTAIN

Amaze and mystify your friends. Earn Money at Clubs and Parties. It's easy. No skill required. Our copyrighted book, **"Fun—Magic—Mystery"** tells how and explains many tricks you can do. Also catalogs over 500 Mystifying Tricks — Illusions — Jokes—Puzzles—Books—European Novelties, at **Reduced Prices. New 1928 Edition,** profusely illustrated, sent postpaid, only 10c.

LYLE DOUGLAS, Station A-3, DALLAS, TEX.

PROMPT SERVICE—LOW PRICES

PRINT Your Own Cards, Stationery, Circulars, paper etc. Save money. Print for others, big profit. Complete Outfits $6.50 up. Job presses $11 up. Rotary $149. Easy rules sent. Write for catalog EXCELSIOR presses, ink type, paper, cards etc. The Kelsey Co., O-47, Meriden, Conn

BE A DETECTIVE

Earn Big Money. Work home or travel. Make secret investigations. Experience unnecessary. Write Dept. S. A. American Detective System, 2190 Broadway, N. Y

word, Drake's eyes fixed with bitter hatred upon Norhala, Ventnor brooding upon her always with that strange understanding. We passed between the walls of the further cleft, and stood for an instant at the brink of the green forest.

There came to us as through immeasurable distances a faint, sustained thrumming—like the tattoo of countless muffled drums. The Thing that carried us trembled. The sound died away and the Thing quieted. It resumed its steady, effortless striding through the crowding trees, but now with none of that speed with which it had come, spurred forward by Norhala's hate.

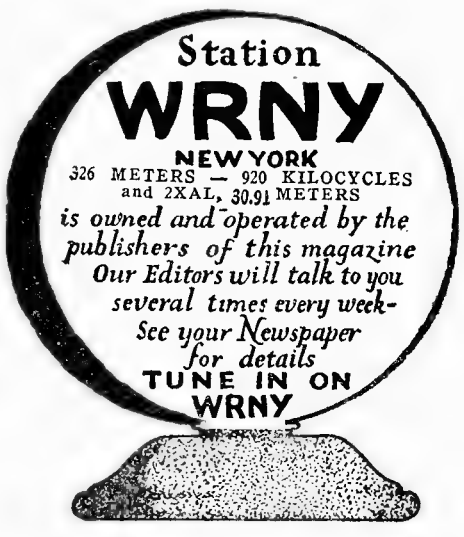
Ventnor stirred and broke the silence. I saw how wasted was his body, how sharpened his face, purged not only by suffering but by, it came to me, some strange, new knowledge.

"No use, Drake," he said dreamily. "All this is now on the knees of the gods. And whether those gods be humanity's or whether they be—Gods of Metal—I do not know.

"But this I do know—only one way or another can the balance fall. And if it be one way, then you and we shall have Ruth back. And if it be the other way—then there will be little need for us to care. For man will be done."

"What do you mean?" I whispered.

"It is the crisis," he answered. "We can



do nothing, Louis, nothing. Whatever it is that is to be comes forth now from the womb of Destiny."

Again there came that distant rolling—louder. Again the Thing trembled.

"The drums," whispered Ventnor. "The drums of destiny! What is it they are heralding? A new birth of Earth and the passing of man? A new child to whom shall be given dominion—nay, to whom has been given dominion?"

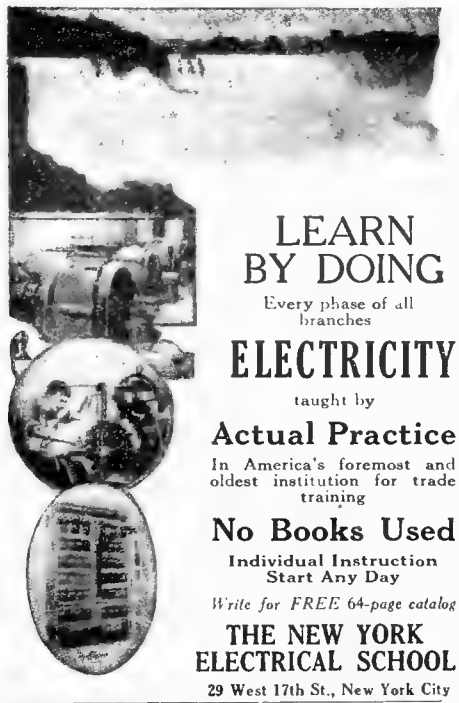
The drumming died. About us was only the swishing, of the sighing, of the falling trees. Motionless stood Norhala, and motionless Ruth.

"Whence did—they—come?" the eyes beneath the red brand were clear and quiet. "Whence did they come—these Things that carry us and that strode like destroying angels over Cherkis's city. Are they spawn of Earth—as we are? Or are they foster children—changelings from another star?

"These creatures which, while many, still are one—which, when one, still are many! Whence did they come? What are they?"

He looked down upon the cubes that held us. Their hosts of tiny eyes shone up at him, mockingly—as though they had heard and understood.

"I do not forget," he went on. "At least I do not forget all of what I saw during that time when I seemed to be only a thinking atom outside space—as I told you, or



LEARN BY DOING

Every phase of all branches

ELECTRICITY

taught by

Actual Practice

In America's foremost and oldest institution for trade training

No Books Used

Individual Instruction
Start Any Day

Write for FREE 64-page catalog

THE NEW YORK ELECTRICAL SCHOOL

29 West 17th St., New York City

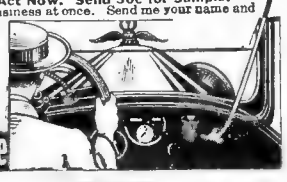
I'll Pay You $6000 a Day! Selling Master Suction Grip Ash Receivers

Yes, my men are making that much and more with the handiest specialty that has struck the field in years. **THE PATENTED MASTER SUCTION ASH RECEIVER.** Attached instantly to any surface, metal, glass or wood. No tools necessary. Just stick it on. The Suction Grip Holds it Firmly. **Comes off in a jiffy for emptying.** Made of Beautiful Bakelite in five distinctive colors and mottled effects. A color to harmonize with every interior. Adds comfort and beauty wherever attached.

Sticks any Place

RETAILS FOR ONLY 75c—YOU MAKE 100%—200% PROFIT EVEN ON DEALER SALES

Regardless what your past experience has been—my four tested selling plans will show you how to easily earn $60 a day and build a steady growing repeat business—selling to dealers—to consumers, or getting orders by mail with dollar bills enclosed with my new patented envelope circular. **it actually starts you in the mail order business. Act Now. Send 50c for Sample.** Get into this big paying business at once. Send me your name and address with 50c (stamps if you like) for special sample Master Ash Receiver and my **FOUR AMAZING SELLING PLANS FREE.**



Gordon Manufacturing Co.
110 East 23d St. New York
Dept. G-37

Home-Auto-Office

Learn to Dance

This New Easy Way

You can learn all the modern dances—Charleston, Black Bottom, Valencia, Canter, French Tango, St. Louis Hop, Latest Waltzes, Fox Trots, etc., at home easily and quickly. New chart method makes dancing as simple as A-B-C. No music or partner required. Learn anywhere, anytime. Win new popularity. Be in demand at parties. Same course of lessons would cost $20 if taken privately.

Send No Money

Just send your name and address. We'll ship the complete course—323 pages, 49 illustrations without one cent in advance. When package arrives, hand postman only $1.98, plus delivery charges, and this wonderful course is yours. Try for 5 days. Money back if not delighted. Send your name NOW.

FRANKLIN PUB. CO. 800 N. Clark St. Dep.-B204 Chicago

RESHAPE your NOSE to beautiful proportions—while you sleep!

ANITA NOSE ADJUSTER is SAFE, painless, comfortable. Speedy, permanent results guaranteed. Doctors praise it. No metal to harm you. Small cost.

Gold Medal Won 1928

Write for FREE BOOKLET

BEFORE-AFTER

ANITA CO., 773 Anita Bldg., Newark, N.J.

PIMPLES

Cleared Up—often in 24 hours.

To prove you can be rid of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers' Itch, Eczema, Enlarged Pores, Oily or Shiny Skin, simply send me your name and address today. **CLEAR-TONE** since 1910 over 500,000 users—simply magical in prompt results. Use like toilet water. You can repay the favor by telling your friends; if not the loss is mine. WRITE TODAY.

E. S. GIVENS, 568 Chemical Bldg., Kansas City, Mo.

thought I told you, speaking with incredible effort through lips eternities away from me, the atom, who strove to open them.

"There were three—visions, revelations—I know not what to call them. And though all seemed real, one only of two can be true, and the third—that may sometime be true, but surely is not yet."

CHAPTER XXVIII

THE GATHERING STORM

THROUGH the air came a louder drum roll. It swelled to a crescendo; abruptly ceased. Norhala raised her head; listened.

"I saw a world, a vast world, Thornton," said Ventnor, "marching stately through space. It was no globe—it was a world of many facets, of smooth and polished planes. A huge blue jewel world, dimly luminous. A crystal world cut out from aether. A geometric thought of the Great Cause, of God if you will, made material. And it was airless, waterless, sunless.

"I drew closer to it. And then I saw that over every facet patterns were traced, gigantic symmetrical designs, mathematical hieroglyphs. In them I read unthinkable calculations, formulas of interwoven universes, arithmetical progressions of armies of stars, pandects of the motions of the suns. In the patterns was an appalling harmony—as though all the laws from those which guide the atoms to those which direct the cosmos were there resolved into completeness—totalled.

"The faceted world was like a cosmic abacist, tallying, as it marched, the errors of the infinite.

"The patterned symbols constantly changed form. I drew nearer—the symbols were alive. They were, in untold numbers—these!"

He pointed to that which carried us.

"I was swept back and looked again upon it from afar. And a notion came to me—fantasy it was, of course, yet built, I know, around a nucleus of strange truth. It was"—his tone was half apologetic—"it was that this jeweled world was ridden by some mathematic god, driving it through space, noting occasionally with amused tolerance the very bad arithmetic of another Deity the reverse of mathematical—a more or less haphazard Deity, the god, in fact, of us and the things we call living.

"It had no mission. It wasn't at all out to do any reforming. It wasn't in the least concerned in rectifying any of the inaccuracies of the other. Only now and then it took note of the deplorable differences

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in reserving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

.....

To ..... Newsdealer

Address .....

Please reserve for me.....copies of SCIENCE AND INVENTION every month until I notify you otherwise, and greatly oblige,

Name .....

Address .....

***I'll Teach YOU Real Professional* MAGIC *at Home* BY MAIL**

Big Stage Illusions

Master Illusions from Europe, India, China, Japan—Guarded secrets of the Orient—Over 150 tricks from small effects to Big Stage Illusions, nearly 1500 illustrations—*that* and *more* is what you get in the Tarbell Course in Magic.

Secrets of the Orient

Yes, those great mysteries the Hindu guards so jealously and famous Magicians have risked their lives to secure—these and MORE are *YOURS* in the great Tarbell Course. Many a mystery here is worth many times the whole cost of the entire course.

"Patter"

Magicians will tell you that "Patter" the name for the entertaining and diverting talk he gives is highly important. The Tarbell Course gives you real professional "Patter!"

Read this Great Endorsement

Dr. A. M. Wilson, Editor of the Sphinx, Official Organ of The Society of American Magicians, pays the Tarbell Course this tribute:

"The greatest work on Magic ever attempted and will mark an epoch in Magic . . . greater than the revelations of Robert Houdini, Father of Modern Magic, 60 years ago."

***The First and Only* Course in Magic**

ever offered to the public teaching Real Professional MAGIC

Money-Back Guarantee Protects YOU

The great Tarbell Course in Magic protects you with an Iron Clad Guarantee, to refund your money if you are not satisfied Youcan't lose. You have everything to gain.

Get Started on the Road to Big Money!

You need not give up your job. You don't have to be a "professional" to make big money. You can make nice money entertaining on the side as a semi-professional, or if you want to, you can become a big Magician, make big money and enjoy fame and glory. Learn all the great limitless opportunities in store for you. Mail Coupon NOW!

Tarbell System, Inc.

1926 Sunnyside Ave., Studio B-142 Chicago

Mail This NOW!

Tarbell System, Inc.
1926 Sunnyside Ave., Studio B-142 Chicago

Tell me all about Dr. Tarbell's new and simple system by which I can learn the secrets of MAGIC. Also tell me about your Low Prices and Easy Payment Plan. No obligation on my part.

Name.....

Address .....

Three Years Ago $40 a Month

—now heads his own business

In 1922 J. H. Bryson, now head of the Bryson Novelty Manufacturing Company, Fayetteville, Tenn., was clerking in a grocery store at $40 a month. Today he is president and proprietor of the firm which bears his name, doing a nation-wide business . . . "Had it not been for LaSalle and the self-confidence and inspiration which came from the knowledge secured from you," writes Mr. Bryson, "I would still be working as a grocery clerk or somewhere in this same channel . . . Nothing I could say would express the gratitude I feel toward LaSalle for my training."

Without cost, would you like to learn what your future can be with LaSalle's help? *The true facts about your opportunities, together with information and data of the utmost value, are contained in a 64-page book which LaSalle will send you if you are sufficiently interested in your future to ask for it.* With it you will receive a copy of "Ten Years' Promotion in One," the inspiring story of how one man, after many wanderings, found the shorter path to responsibility and power. Action today means a bigger job and better pay in the months to come. Fill in, clip and mail the coupon NOW!

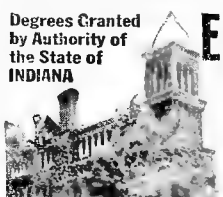
— — — *Find Yourself Thru LaSalle!* — — —

LASALLE EXTENSION UNIVERSITY
The World's Largest Business Training Institution
Dept. 7384-R Chicago

I should be glad to learn about your *salary-increasing plan* as applied to my advancement in the business field checked below. Send also copy of "Ten Years' Promotion in One," all without obligation.

- ☐ Modern Salesmanship
- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Railway Station Management
- ☐ Law—Degree of LL.B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Factory Management
- ☐ Banking and Finance
- ☐ Modern Business Correspondence and Practice
- ☐ Modern Foremanship
- ☐ Personnel and Employment Management
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Business English
- ☐ Commercial Spanish
- ☐ Effective Speaking
- ☐ Stenotypy

Name .....
Present Position .....
Address .....



Degrees Granted by Authority of the State of INDIANA

ENGINEERING DEGREE in 2 Years!

No entrance exams required. And if you haven't a high-school diploma we'll give you the essential subjects.

LOW TUITION
—small living expense

Rooms in private homes $2.00 to $3.00 a week. Meals $3.50 to $5.00 a week. Tuition about half the average. Employment service for graduates, free. No extra fees except for chemistry laboratory materials. Wonderful bunch of students. Terms start Sept., Jan., March, June. Mail coupon for free catalog.

Electrical
Civil
Mechanical
Chemical
Administrative

If you want to be a graduate ENGINEER and earn $50 to $150 a week, come to TRI-STATE College. We are interested in helping men who may be short of money and time, but are strong in the desire to improve themselves. Time cut to 96 weeks by eliminating frills and concentrating on Science, Mathematics, Drafting, Laboratory and field-work.

B. S. (Bachelor of Science) degree in Engineering conferred by State authority.

TRI-STATE COLLEGE, Box E-B!!! Angola, Ind

Tri-State College, Box E-B!!! Angola, Indiana
Send free book of complete information of your 2 year Engineering Courses. (Mark X at left.)

- [ ] Civil
- [ ] Electrical
- [ ] Mechanical
- [ ] Chemical
- [ ] Administrative

Name .....
Address .....

Learn Photography at HOME

Make money taking pictures. Prepare quickly during spare time. Also earn while you learn. No experience necessary. New easy method. Nothing else like it. Send at once for free book, ***Opportunities in Modern Photography***, and full particulars.

AMERICAN SCHOOL OF PHOTOGRAPHY
Dept. 142-B 3601 Michigan Ave. Chicago, U. S. A.

Earn Money Gathering Butterflies—Insects

We require many kinds for scientific collections. Will pay 25c to 10 dollars each. Pleasant and profitable outdoor work under our instructions. Send 10c (coin) for Illustrated Prospectus.

CALIFORNIA LABORATORIES
Box 1771, Los Angeles, Cal.

between the worlds it saw, and its own impeccably ordered and tidy temple with its equally tidy servitors.

"Just an itinerant demiurge of super-geometry riding along through space on its perfectly summed-up world; master of all celestial mechanics; its people independent of all that complex chemistry and labor for equilibrium by which we live; needing neither air nor water; heeding neither heat nor cold; fed with the magnetism of interstellar space and stopping now and then to banquet off the energy of some great sun."

A thrill of amazement passed through me. Fantasy all this might be but—how if so, had he gotten that last thought? He had not seen, as we had, the orgy in the hall of the cones, the prodigious feeding there upon our sun.

"That passed. I saw vast caverns filled with these things, working, growing, multiplying. In caverns of our Earth—the fruit of some unguessed womb? I do not know.

"But in those caverns, under countless orbs of many colored lights, they grew. It came to me that they were reaching out toward sunlight and the open. They burst into it—into yellow, glowing sunlight. Ours? I do not know. And that picture passed."

His voice deepened.

"There came a third vision. I saw our Earth—I knew, Louis, indisputably, unmistakably that it was our earth. But its rolling hills were leveled, its mountains were ground and shaped into cold and polished symbols—geometric, fashioned.

In that wide ring, girdling the shimmering structure like a circled sanctuary, were but three forms. One was the wondrous Disc of jeweled fires I have called the Metal Emperor. The second was the sullen fired cruciform shape of the Keeper.

The third was Norhala.

She stood at the side of that weird master of hers—or was it, after all, the lover?

"The seas were fettered, gleaming like immense jewels in patterned settings of crystal shores. The very Polar ice was chiseled. On the ordered plains were traced the hieroglyphs of the faceted world. And on all Earth, Thornton, there was no green life, no city, no trace of men. On this Earth that had been ours were only—These.

"Visions" he said. "Don't think that I accept them in their entirety. Part truth, part illusion—the groping mind dazzled with light of unfamiliar truths and making pictures from half light and whole shadow to help it understand.

"But still—some truth in them. How much I do not know. But this I do know—that last vision was of a cataclysm whose beginnings we face this very instant."

A picture flashed behind my own eyes—of the walled city, its thronging people, its groves and gardens, its science and its art;

The RADIO NEWS AMATEURS HANDIBOOK

THE 50¢ COPY

for TECHNICAL RADIO FANS

THE RADIO NEWS AMATEURS' HANDIBOOK is an invaluable guide and reference book for every radio enthusiast. The most complete work of its kind ever published. Every worthwhile development since the beginning of Radio can be found somewhere within its pages.

Radio Amplincation; Audio Amplification; Power Amplification; "A and B" Power Circuits; Electric Sets; Short Wave Transmission and Circuits—each of these important phases of Radio and many others are completely covered in this remarkable book.

Radio Fans, Custom Set Builders, and those studying Radio cannot afford to be without a copy of this complete handibook on Radio.

112 pages—large magazine size replete with illustrations

RADIO NEWS AMATEURS' HANDIBOOK, the most complete chronicle of Radio ever compiled.

THE **50c** COPY

AT ALL NEWSSTANDS
OR WRITE DIRECT—

EXPERIMENTER PUBLISHING CO.
230 Fifth Ave. New York, N. Y.

EXPERIMENTER PUBLISHING CO.
230 Fifth Ave., New York, N. Y.
Gentlemen: Enclosed find 50c., for which kindly send me a copy of the new, up-to-date RADIO NEWS AMATEURS' HANDIBOOK.

Name.. .....
Address.....
City..... State.....

Only a Buescher

Gives You All These Features

Patented Snap-on Pads—the greatest improvement for beauty of tone—easy to replace—no more cementing. Found only on the Buescher.

Patented Automatic Octave Key—always positive.

Perfect scale accuracy—every tone always full, clear and true.

Hands never moved from one playing position.

Easier to play because of many exclusive improvements.

Convenient key arrangement, simplifies fingering of rapid passages.

"Greatest Sax"

"By the advice of a friend, I bought a Buescher Saxophone, and I know now I made the right choice. Its beauty, easy action and latest improvements make it the greatest sax on the market." — Harry Dixon Loes, Three Rivers, Mich.

Easy to Pay

Agreeable payments arranged and 6 days' trial on any Buescher Saxophone, Cornet, Trumpet, Trombone or other instrument. Send your name for free Saxophone Book or ask for circular on any other instrument.

Buescher Band Instrument Co.
2545 Buescher Block (469) Elkhart, Ind.

BLANK AUTOMATIC

22 CAL., SIX SHOT

With 100 Blank Cartridges FREE

No permit or License Required

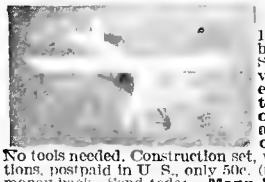
You need no permit or license to own this newly-invented, high-power, but absolutely safe and harmless automatic. Positively not a toy. Built like a real automatic, same in construction, appearance, finish, weight and every other detail—except that it fires blank cartridges only. Handy for self-defense, frightens tramps, scares away dogs; handy in the house—a real home protector—without the danger of keeping dangerous firearms at home. Play a practical joke on your friends. Ideal at festivals, fairs, picnics, outings, camping, hikes, outdoor sports, etc., etc. Blue steel, case-hardened frame, a duplicate of internationally famous German automatic. Makes powerful loud report. Has six-shot magazine that can be reloaded instantly. Uses standard blank cartridges. Checkered grip. Box of 100 cartridges free with each automatic. Convenient pocket size. Send No Money. Pay on delivery $4.99 and express charge. JENKINS, 621 Broadway, New York, Dept. 65 J 7.

You-and This New Machine Can Earn $500 a Month

Operate a Tire Repair Shop

90,000,000 Tires in use. America's greatest opportunity for men with small capital. We furnish everything—$100 and up. Easy payments. We train you FREE right at home. Start making money at once. Write today for Free Book of Opportunity.

HAYWOOD TIRE EQUIPMENT CO.
2337-K Ogden Ave. Chicago, Illinois



AIRPLANE

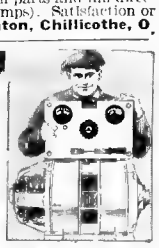
12-inch scale model of Lindbergh's Spirit of St. Louis. Scientifically designed and very realistic. Only scale model priced under five dollars that will rise from ground by own power. Flies 30 ft. or more and stays in air 8 to 10 seconds. Easily built in 3 hours. No tools needed. Construction set, with all parts and full directions, postpaid in U. S., only 50c. (no stamps). Satisfaction or money back. Send today. **Mann & Benton, Chillicothe, O.**

HB CHARGING

Only $16 Monthly

Start your own big business now. Small payments brings complete outfit for recharging auto and radio batteries. Easy terms. Moneyback guarantee. Write to

HOBART BROS. CO.
Box S78, Troy, Ohio



EASILY CLEARS $150 TO $300 MONTHLY PROFIT

Foreign Work!

Like to Travel—Does Romantic, Wealthy South America call you? Unusual opportunities for young men. American employers. Fare and expenses furnished. BIG PAY. Write for Free List

SOUTH AMERICAN SERVICE BUREAU
14600 Alma Ave., Detroit, Michigan

of Destroying Shapes trampling it flat—and then the dreadful desolate mount.

And suddenly I saw that mount as Earth—the city as all Earth's cities—its gardens and groves as all Earth's fields and forests—and the vanished people of Cherkis seemed to expand into all humanity!

The drums again burst forth—no longer muffled nor faint. They roared. They seemed to pelt the air and drop upon us. They beat about our ears with thunderous rhythm, like covered caverns drummed upon with trunks of giant trees.

The drumming steadily grew louder, more vehement, defiant and deafening. Under our feet a mighty pulse began to throb, accelerating to the rhythm of that clamorous roll.

Norhala drew herself up, sharply and stood listening and alert. Under my feet, the throbbing turned to an uneasy churning, a ferment.

"Drums!" muttered Drake. "They're no drums. It's drum fire. It's like a dozen Marnes, a dozen Verduns."

"Drums!" whispered Ventnor. "They *are* drums. The drums of Destiny!"

Louder grew the roaring. That which bore us halted. The tower that upheld Ruth and Norhala swayed. It bent over the gap between us, and touched the top on which we rode. Maid and woman were plucked up, and swiftly they were set beside us.

There was a shrill, keen wailing—louder than ever I had heard the Things utter, an earthquake trembling, a maelstrom swirling, a swift sinking.

The bulk beneath us split. Up before us arose a stupendous, stepped pyramid, little smaller than that which Cheops built to throw its shadow across the Nile. Into it streamed, and over it clicked, score upon score of the cubes, building it higher and higher.

It lurched forward, and away from us.

From Norhala came a single cry—resonant, blaring like a wrathful trumpet. The runaway shape halted, hesitated, and seemed about to return. An abrupt rattle of the drumming crashed out peremptory, commanding. The shape darted forward and raced away.

Great eyes wide and filled with incredulous wonder, a stunned disbelief, Norhala for an instant faltered. Then out of her white throat, through her red lips, pelted a tempest of staccato buglings.

What was left of the Thing leaped and flew forward.

In the distance was the sapphire spark of Norhala's home. Not far from it now was the fleeting pyramid. And it came to me again that it was strange that within that rushing shape was neither globe nor pyramid. A sapphire spark grew to a glimmering azure marble. Steadily we gained. Never for an instant ceased that scourging hail of notes from Norhala, and never for an instant lessened the clamor that seemed to try to smother them.

The marble became a ball, and then a great globe. The Thing we pursued lifted itself into a prodigious pillar. The pillar's base thrust out stilts. It stepped over the blue dome of Norhala's house.

The blue bubble was close, and now it curved below us. We were set gently before its door. I looked up at the chimera that had carried us.

Throughout it was awful movement. Its units writhed within it.

And nowhere in its seething mass could I see a single cube!

A half score of globes and pyramids swirled out of it and ranged themselves between Norhala and the seething Things. It rushed toward the cannon mouth of the Pit and was lost to sight in the mists.

Upon Norhala's face as she watched it go was dismay, uncertainty that held in it something indescribably pitiful. She tightened her grasp upon dreaming Ruth, and motioned us to pass within. We went si-

Would You Like To Earn More Money in Work That's Almost Romance?

Then be a RADIO EXPERT!

J. E. SMITH
President

IF you're earning a penny less than $50 a week, clip coupon below. Get my big Free Book telling about opportunities for big money in Radio, Television, trans-Atlantic Radio telephony, many other wonderful inventions and developments constantly creating big new Radio opportunities. Here's work that's almost romance, a NEW, speedy, growing, live-wire profession.

And Radio needs trained men! Salaries from $50 all the way up to $250 a week are not unusual. You can easily learn Radio for bigger pay by my tested, practical methods. Hundreds of men have already done it. You learn quickly in your spare hours AT HOME—it's all so interesting to you that it's easy!

Extra Dollars For You Almost At Once

Think of making $15, $20, $30 extra every week "on the side," without interfering with your regular job! I'll teach you to do it almost at once after you start your Radio training with me, by using spare time that you're wasting now. And all the while you'll be getting ready for the bigger Radio jobs ahead!

Six Big Outfits of Practice Material Given Free of Extra Cost

With your training you get free of extra cost 6 great outfits of real Radio practice material. With these 6 outfits you can build 100 **real** Radio circuits. This is the **practical** kind of home training. You learn to hold a job—not on paper — ON THE PAY-ROLL. Send coupon below for details of this offer.

You can easily pay for your course and put money in the bank while learning, when you learn by my practical methods. And you don't need to leave home, or interfere with the job you have now, while you're doing it! Fill out and mail the coupon below for the big book of Facts and Proof.

64-Page Book Sent Free

When I receive your coupon I'll mail you my big 64-page Book immediately. It's filled with photos and facts about the opportunities in Radio, and tells how you can prepare, quickly and easily in your spare time at home, to be an expert in this field. No previous Radio experience needed to take advantage of this offer. No special schooling required. Mail coupon now—address J. E. Smith, President.

J. E. SMITH, President
National Radio Institute,
Dept. 7T, Washington, D. C.

Dear Mr. Smith: Kindly send me your 64 page Free Book, which tells about learning Radio for bigger pay. Also send information on your offer of 6 outfits of material free of extra cost. I understand this places me under no obligation.

Name . . . . . .

Address . . . . . .

Town . . . . . State . . . . . .

Occupation . . . . . .

"What would I do if I lost my job?"

SUPPOSE your employer notified you to-morrow that he didn't need you any longer? Have you any idea where you could get another position?

Don't have this spectre of unemployment hanging over your head forever. Train yourself to do some one thing so well that your services will be in demand. Employers don't discharge such men. They *promote* them!

Decide to-day that you are going to get the specialized training you must have if you are ever going to get—*and keep*—a real job at a real salary. It is easy if you really try.

Right at home, in the odds and ends of spare time that now go to waste, you can prepare for the position you want in the work you like best. For the International Correspondence Schools will train you just as they are training thousands of other men—no matter where you live—no matter what your circumstances.

At least find out how, by marking and mailing the coupon printed below. There's no cost or obligation, and it takes only a moment of your time, but it may be the means of changing your whole life.

Mail the Coupon To-day!

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 6239-E, Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X:

☐ Industrial Management
☐ Personnel Management
☐ Traffic Management
☐ Business Law
☐ Accounting and C.P.A. Coaching
☐ Cost Accounting
☐ Bookkeeping ☐ French
☐ Secretarial Work
☐ Spanish ☐ Salesmanship
☐ Advertising
☐ Business Correspondence
☐ Show Card and Sign Lettering
☐ Stenography and Typing
☐ Civil Service
☐ Railway Mail Clerk
☐ Common School Subjects
☐ High School Subjects
☐ Magazine and Book Illustrator
☐ Cartooning

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineer
☐ Electric Lighting
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Machine Shop Practice
☐ Railroad Positions
☐ Gas Engine Operating
☐ Civil Engineer
☐ Surveying and Mapping
☐ Metallurgy ☐ Mining
☐ Steam Engineering ☐ Radio
☐ Architect
☐ Architects' Blueprints
☐ Contractor and Builder
☐ Architectural Draftsman
☐ Concrete Builder
☐ Structural Engineer
☐ Chemistry ☐ Pharmacy
☐ Automobile Work
☐ Airplane Engines
☐ Agriculture and Poultry
☐ Mathematics

Name .....
Street Address .....
City ..... State .....
Occupation .....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal

We start you in business and help you succeed

New plan. No experience or capital needed. We furnish everything. Spare or full time. You can easily make

$50-$100 weekly

Write at once
Madison Shirt M'f'rs, 564 Broadway, N. Y.

30 Days' Free Trial New Models now ready for delivery direct from our factory. *Astonishing* low prices and terms. Do not buy until you get them. RIDER AGENTS WANTED to ride and exhibit sample. Make big money. Many models $21.50 up. *Guaranteed $1.50 each*, wheels, **Tires** lamps, horns, equipment at *half usual prices*. Send No Money. Write for our marvelous prices and terms on RANGER Bicycles.

Mead CYCLE CO. Dept. C-107 CHICAGO

lently. She came behind us, followed by three of the great globes, a pair of the tetrahedrons. She halted beside a pile of the silken stuffs. Ruth's eyes dwelt upon hers, trustfully.

"I am afraid!" whispered Norhala. "Afraid—for you."

"She looked down upon her, the galaxies of stars in her eyes all soft and tremulous.

"I am afraid, little sister," she whispered again. "Not yet can you go as I do—among the fires." She hesitated. "Rest here until I return. I leave these to guard and obey you."

She motioned to the five shapes. They drew themselves around the girl. Norhala kissed her.

"Sleep till I return," she murmured.

She swept from the chamber, with never a glance for us three. There was a little wailing chorus without, fast dying into silence.

Spheres and pyramids twinkled at us, guarding the silken pile whereon Ruth lay asleep.

Down upon the blue globe burst a clangour like that of hollow metal worlds, beaten and shrieking.

CHAPTER XXIX

THE PASSING OF NORHALA

FOR many minutes we stood silent, in the shadowy chamber, listening, each absorbed in his own thoughts. The drumming was continuous. Sometimes it faded into a background for clattering storms as of thousands of machine guns, thousands of riveters at work at once upon a thousand metal frameworks. Sometimes it was submerged beneath splitting crashes as of meeting meteors of hollow steel.

But always the drumming persisted, rhythmic, thunderous.

Through it all Ruth slept, undisturbed; the two great pyramids erect behind her, watchful; a globe at her feet, a globe at her head, the third sphere poised between her and us, and, like the pyramids—watchful.

Ventnor stepped by the sentinel globe and bent over the tranced girl. Sphere nor pyramid stirred, but like a palpable thing one felt their watchfulness. He listened to her heart, caught up a wrist and took note of her pulse. He drew a deep breath, stood upright, nodded reassuringly, and rejoined us.

The blue bower trembled under a gust of sound. Ruth stirred, her brows knitted and her hands clenched. The sphere that stood in front of her spun on its axis, swept up to the globe at her head, and glided from it to the globe at her feet—as though whispering.

$5,000 for Perpetual Motion

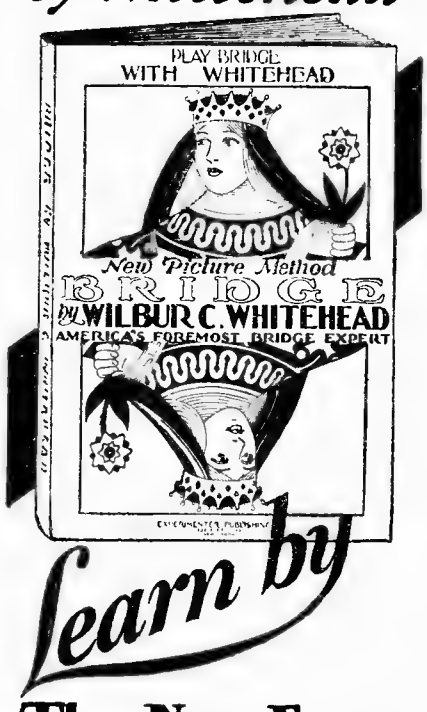
The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stocks for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

Bridge-by Whitehead



Learn by

The New Easy "Picture Method"

The world's greatest Bridge player, Wilbur C. Whitehead, now reveals the secret of his success in this remarkable instruction book, "BRIDGE by Whitehead." Mr. Whitehead's new "Picture Method" of instruction makes Bridge easy for all. Every play is clearly illustrated—each step fully explained.

Follow Radio Bridge instruction with greater ease — obtain a copy of "BRIDGE by Whitehead"—you cannot fail to grasp the game.

How efficient are you at the play? Do you know what to bid and where to bid it? What do you know of the auction; the book and odd tricks; rank of bids; the pass; the double; the redouble; the contract? Who is the declarer; the adversaries; the dummy? Keeping score, honors, slams, and the rubber—each is fully explained in Whitehead's new easy "PICTURE METHOD." Complete instructions on every phase of America's greatest indoor sport.

Get Your Copy Today
At All Newsstands or Write Direct

THE 50c COPY

EXPERIMENTER PUBLISHING CO.
230 FIFTH AVENUE, NEW YORK, N. Y.

EXPERIMENTER PUBLISHING CO.
230 Fifth Ave., New York, N. Y.
Gentlemen: Enclosed find fifty cents, for which please send me a copy of BRIDGE by Whitehead.

Name. .....
Address. .....
City. ..... State. .....

The Breakers

on the Oceanfront

ATLANTIC CITY, N. J.

PREFERRED—

In Spring and all seasons by those who know and wish the best upon either the American or European Plan—Sensible Rates withal.

Hillman Management

When in Washington visit Harvey's Restaurant, 11th and Penna. Avenues. Famous since 1858.

TRAFFIC INSPECTORS
NEVER NEED TO HUNT FOR JOBS!

Every graduate is assisted to a position paying $120 a month to start, plus expenses or tuition is refunded. Three months' spare time study and you begin immediately on a fascinating career in Traffic Inspection. You travel as your own boss on outdoor work with regular hours—seeing new places and faces each day—no selling. **EARN UP TO $250 A MONTH.** With experience you will soon earn from $185 to $250 a month. Write today for Free Booklet telling of actual successes of hundreds of graduates and read the tuition refund contract that makes your future a certainty.

STANDARD BUSINESS TRAINING INSTITUTE
Division 27 - - - - - Buffalo, N. Y.

THE MIDGET SLIDE RULE instantly adds, subtracts, multiplies, divides, solves proportion, gives all roots and powers. Logarithms, Sines, Cosines, Tangents, Cotangents, etc. Also gives decimal equivalents, lettered and numbered drill and tap sizes.

More than 110,000 sold, more than 2,000 unsolicited testimonials. The Engine-divided scales are on whitefinished aluminum and are grease and waterproof. Diameter 4". Price with Instruction Book, $1.50. Pocket Carrying Case, 50c extra, Cash or C.O.D. Catalogue free. Your money back if you are not satisfied.

GILSON SLIDE RULE COMPANY. Stuart, Florida

SECRETS!

The world's most amazing book, the "Silent Friend"—Marriage Guide and Medical Adviser, reveals hundreds of secrets hidden from the public for centuries. Exposes ancient magic, curious arts, conjuring, secrets of lovers, gamblers, money-makers; unseals the Forbidden Cabala; includes the Treasure Casket of Mysteries, Ways to Wealth, Beauty Secrets, Manufacturing Formulas, Animal Training, Divination, Talismans and Charms. Ten astounding books in one great volume. For adults only. Send No Money. Pay postman only $1.79 and postage on delivery. Sent sealed.

WINEHOLT CO., Dept. 161, Woodbine, Penna.

HOW TO OBTAIN

A Perfect Looking Nose

My latest improved Model 25 corrects now ill-shaped noses quickly, painlessly, permanently and comfortably at home. It is the only noseshaping appliance of precise adjustment and a safe and guaranteed patent device that will actually give you a perfect looking nose. Write for free booklet which tells you how to obtain a perfect looking nose. M. Trilety, Pioneer Noseshaping Specialist, Dept. 3107, Binghamton, N. Y.

Ruth moaned, her body rose upright, then swayed rigidly. Her eyes opend. They stared through us as though upon some dreadful vision; and strangely was it as though she were seeing with another's eyes, were reflecting another's suffering. The globes at her feet and at her head swirled out and clustered against the third sphere—three weird shapes in silent consultation. On Ventnor's face I saw pity, and vast relief. I realized that for some unguessed reason Ruth's agony was calling forth in him—elation.

"Norhala!" he whispered. "She is seeing with Norhala's eyes, is feeling what Norhala feels. It's not going well with—That—out there. If we dared leave Ruth—could only see—"

Ruth leaped to her feet. She cried out—a golden bugling that might have been Norhala's own wrathful notes. Instantly the two pyramids flamed open and became two gleaming stars that bathed her in their violet radiance. Beneath their upper tips the blasting ovals glittered—menacingly.

The girl glared at us. More brilliant grew the glittering ovals, as though their lightnings trembled on her lips.

"Ruth!" called Ventnor.

A shadow softened the hard brilliancy of the brown eyes. In them something struggled to arise, fighting its way to the surface like some drowning human thing. It sank back. Upon her face dropped a cloud of heartbreak, appalling woe.

There stared upon us a stripped spirit naked and hopeless and—terrible.

She screamed once more. The central globe swam to her. It raised her upon its back, and glided to the doorway. She stood upon it, poised like some youthful, anguished Victory. Standing so upon that enigmatic orb on bare slender feet, one sweet breast bare, hands upraised, virginally archaic, there was nothing about her of the Ruth we knew.

"Ruth!" cried Drake. Despair as great as that upon her face was in his voice. He sprang before the globe that held her and barred its way.

For an instant the sphere paused—and in that instant the human soul of the girl rushed back.

"No!" she cried. "No!"

A call issued from the white lips—stumbling, uncertain, as though she who sent it forth wondered whence it sprang. The angry stars closed. The three globes spun—doubting, puzzled. Again she called—a tremulous, halting cadence. She was lifted, and dropped gently to her feet.

For an instant globes and pyramids whirled and danced before her. Then sped away through the portal.

Ruth swayed, sobbing.

She ran to the doorway. She fled through it. We sprang after her. Rods ahead her white body flashed, speeding toward the Pit. Like fleet-footed Atalanta she fled—and far, far behind us was the blue bower, the misty barrier of the veils close, when Drake with a last desperate burst, reached her side and gripped her.

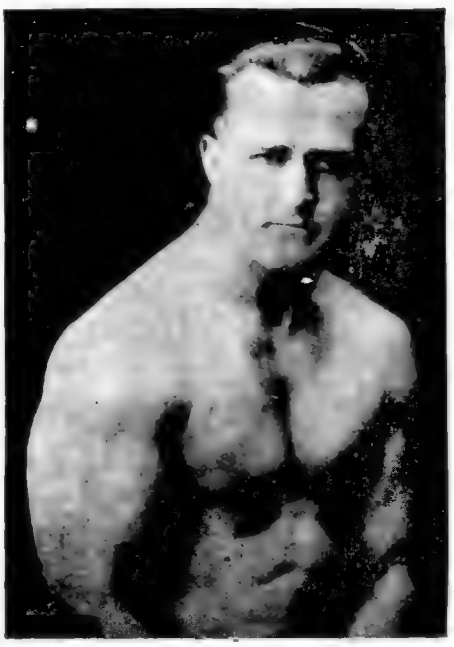
The two fell, rolling upon the smooth roadway. Silently she fought, biting, tearing at Drake, struggling to escape.

"Quick!" gasped Ventnor, stretching out an arm to me. "Cut off the sleeve. Quick!"

Unquestioning, I drew my knife and ripped the garment at the shoulder. He snatched the sleeve and knelt at Ruth's head. He crumpled an end of the cloth and thrust it roughly into her mouth. He tied it fast, gagging her.

"Hold her," he ordered Drake; and with a sob of relief sprang up. The girl's eyes blazed at him, filled with hate.

"Cut that other sleeve," he said. And when I had done so he knelt again, pinned Ruth down with a knee at her throat, turned her over and knotted her hands behind her. She ceased struggling. Gently, he drew up



EARLE E. LIEDERMAN, the Muscle Builder
Author of "Muscle Building," "Science of Wrestling," "Secrets of Strength," "Here's Health," "Endurance," etc.

How Do You Look In A Bathing Suit?

Now that the good old swimming days will soon be here again—are you ashamed to appear in a bathing suit? If you're the flat-chested, skinny-armed, watery-eyed imitation of a man I've seen so often on the beaches, I don't blame you for being ashamed. Many a man's put up a good front, as long as he could wear his street clothes, but in a *bathing* suit, *what a surprise!* It's the same old story—*girls want big, husky, well-developed men to put around with.* They want men who can protect them—men they can be proud of. If you're not that kind of a man, I'm sorry for you, but I'll be more than sorry if you don't jump at this chance to change your whole physical appearance almost overnight.

It's Not Too Late!

Yes, sir! *Within just thirty days*—before the summer even begins—I can remake you so that you will hardly know yourself. It will mean work, but the results will be positively uncanny. You'll add one whole inch of real he-man muscle to your arms, and two full inches of steely strength across your chest. Your shoulders will broaden as if by magic, your head snap back erect. Your neck will grow strong and sturdy. There will be a new sparkle of life in your eyes, and you'll be so full of pep and vitality your friends won't be able to hold you down.

I've Rebuilt Over 100,000 Others

I don't care how weak and puny you are now. I'm not called the Muscle-Builder for nothing. I've got my reputation by taking fellows just like you, and making muscular marvels out of them. The more hopeless you think your case is, the more I actually can do for you. It's all in knowing how. Remember, I don't just make these statements. I guarantee to do these things. You can't fail, because it's all worked out scientifically.

Time is short, and you can't begin too soon. Let me show you a short cut to health and strength, and a body that Nature intended you should have. I've done it for over 100,000 others and I can do it for you.

Send for My New Book

"MUSCULAR DEVELOPMENT"

IT IS FREE!

Take it and read it. It's the peppiest piece of literature you ever flashed your eyes on. And 48 full-page photos of myself and some of my numerous prize-winning pupils. This is the finest collection of strong men ever assembled into one book. Look them over—doctors, lawyers, merchants, mechanics and every line of trade you can think of. I swear you'll never let this book get out of your hands again. And just think—you're getting it for nothing. Don't hesitate—there's no strings attached to it. Grab it.

Take your pen or pencil and fill out the coupon—But *do it now*—before you turn this page.

EARLE E. LIEDERMAN
DEPT. 2707 305 BROADWAY, N. Y.

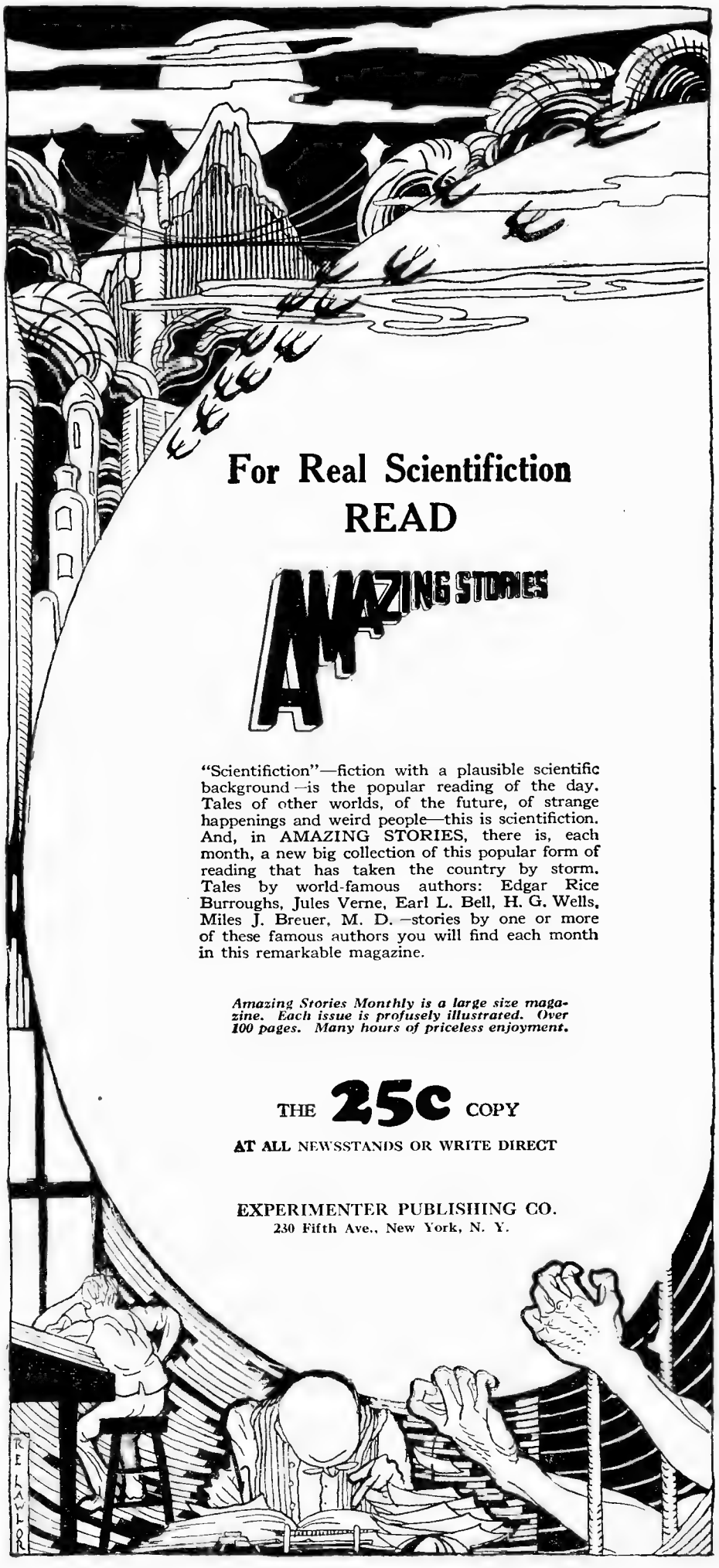
EARLE E. LIEDERMAN
Dept. 2707, 305 Broadway, New York City

Dear Sir: Please send me, without any obligation on my part whatever, a copy of your latest book, "Muscular Development." (Please write or print plainly.)

Name .....

Address .....

City ..... State .....


For Real Scientifiction
READ
AMAZING STORIES
"Scientifiction"—fiction with a plausible scientific background—is the popular reading of the day. Tales of other worlds, of the future, of strange happenings and weird people—this is scientifiction. And, in AMAZING STORIES, there is, each month, a new big collection of this popular form of reading that has taken the country by storm. Tales by world-famous authors: Edgar Rice Burroughs, Jules Verne, Earl L. Bell, H. G. Wells, Miles J. Breuer, M. D. —stories by one or more of these famous authors you will find each month in this remarkable magazine.
Amazing Stories Monthly is a large size magazine. Each issue is profusely illustrated. Over 100 pages. Many hours of priceless enjoyment.
THE 25c COPY
AT ALL NEWSSTANDS OR WRITE DIRECT
EXPERIMENTER PUBLISHING CO.
230 Fifth Ave., New York, N. Y.
R. E. LAWLOR

the curly head and swung her up on her back.

"Hold her feet." He nodded to Drake, who caught the slender bare ankles in his hands.

She lay there, helpless.

"Too little Ruth, and too much Norhala!" said Ventnor, looking up at me. "If she'd only thought to cry out as she ran. She could have brought a regiment of those Things down to blast us. And would—if she had thought. That's why I gagged her. We don't dare trust to Ruth coming back. And you don't think that is Ruth, do you?"

He pointed to the pallid face, the glaring eyes from which cold fires flamed.

"No, you don't!" He thrust out a foot, caught Drake by the shoulder. "Damn it, Drake—don't you understand?"

For suddenly Ruth's eyes had softened. She had turned them on Drake pitifully appealingly—and he had loosed her ankles and was leaning forward as though to draw away the band that covered her lips.

"Your gun," whispered Ventnor to me. Before I could move he had snatched the automatic from my holster and had covered Drake with it.

"Drake," he said, "stay where you are. If you move another inch I'll shoot you—by God, I will!"

Drake halted.

"But it's hurting her," he muttered. Ruth's eyes still soft and pleading, dwelt upon him.

"Hurting her!" exclaimed Ventnor. "Man—she's my sister. I know what I'm doing. Can't you see? Can't you see how little Ruth is in that body there—how little of the girl you love? How or why I don't know—but that it is so I do know. Drake—have you forgotten how Norhala beguiled Cherkis? I want my sister back. I'm helping her to get back. Now let be. I know what I'm doing. Look at her."

We looked. In Ruth's face was nothing of Ruth! There was the same cold awesome wrath that had rested upon Norhala as she watched Cherkis weep over the eating up of his city. Then swiftly came a change—like the sudden smoothing out of the rushing waves of a hill-locked, wind-lashed lake.

The face was again Ruth's—and Ruth's alone. The eyes were Ruth's eyes—supplicating, adjuring.

"Ruth!" Ventnor cried. "While you can hear—am I not right?"

She nodded vigorously, sternly. She was lost, hidden once more beneath that phantom Norhala.

"You see!" he turned to us grimly. We bowed our heads.

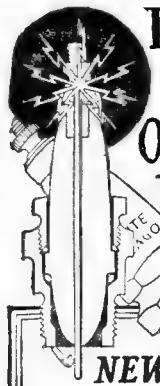
A shattering shaft of light flashed upon the veils, almost piercing them. An avalanche of sound passed high above us.

"We've got to see," whispered Ventnor. "We've got to get through and see what's happening. Win or lose—we've got to know. Cut off your sleeve, as I did," he motioned to Drake. "Tie her ankles. We'll carry her."

It was done. Ruth's light body swinging between brother and lover, we moved forward. We passed into the mists and crept cautiously through their dead silences.

We passed out of them and fell back from a searing chaos of light, a chaotic tumult. From the slackened grip of Ventnor and Drake the body of the girl dropped while we three stood blinded, deafened. She twisted and rolled toward the brink. Ventnor threw himself upon her and held her fast.

Crawling on our knees and dragging Ruth with us, we crept back. We stopped when the thickness of the mists allowed us still to see through them, yet interposed a curtaining which, though tenuous, dimmed the intolerable brilliancy that filled the Pit, and muffled its din to a degree to be borne.



If You Own a Car~You Can Obtain 30 Days Demonstration FREE!

MORE MILEAGE
MORE POWER
MORE SPEED

NEW SPARK PLUG

Famous new Lynamite Spark Plug saves $2 out of every $10 spent for gas. Vacuum Transformer Chamber produces big blue-white spark, many times stronger than ordinary faint red spark. Fires at 200 pounds compression. Gives 15% more power. Fires 20% leaner mixture. Prevents carbon. Fires thru oil. Gets you over hills. Sturdily built for lifetime use. Eigholz, Cal., writes: "Over 30,000 miles without a miss." Three million already on cars.

SEND IMMEDIATELY

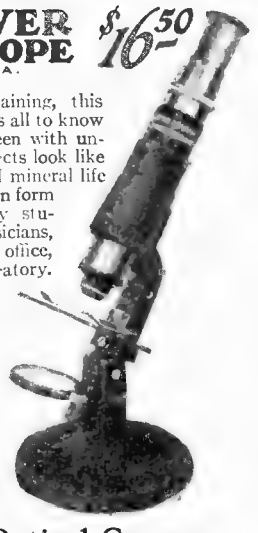
Just state make and year of your car and number of cylinders. Complete set **Lynamite** Plugs will be sent absolutely **Free.** State if liberal Agents' Proposition should be included. Use 30 days entirely at our expense. See what amazing results you get and then either send $1 for each plug or return to us. You risk nothing, so send now—TODAY—to Dept. 863-K.

No-Deposit No C.O.D

LYDON MFG. CO.
180 N. Wabash Ave., CHICAGO

250 POWER MICROSCOPE $16.50

MADE IN U.S.A.



Educational, entertaining, this fine microscope helps all to know life that can't be seen with unaided eye. Tiny insects look like monsters. Plant and mineral life reveal new wonders in form and color. Used by students, dentists, physicians, scientists—in home, office, school, and laboratory. Precise optical qualities

Magnifies 100 to 250 times. Tilting stand, fine finish, nickel trim, plush-lined case, prepared slide, instructions. At your dealer or direct postpaid. Money back guarantee. Other models $2.50 and $8.50.

Catalog Free

Wollensak Optical Company
862 Hudson Avenue Rochester, N.Y.

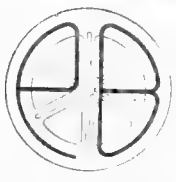
SCIENTIFIC MARVEL LIGHTER WINDPROOF

What Makes It Light?

All guaranteed. Sample 25 cents. Sample Gold or Silver plated, $1.00. Does the work of expensive Lighters.

Agents Write for Prices

NEW METHOD MFG. CO.
Box S.I.7 Bradford, Pa.



TELEVISION

Specially prepared Aluminum Discs —16"—50 holes—ready for ⅛" shaft mounting, per pair..... $10.00
24"—48 holes ready for motor mounting, each 15.00
We supply other apparatus for Television experiments

Cash with your order

POHL BROTHERS
3541 Michigan Av., Detroit, Mich

DEAFNESS — THE MEGA-EAR-PHONE

"There are many good things to be heard"

A Comfortable, Invisible Ear Device (Not Rubber); relieves CATARRHAL DEAFNESS, Stops Head Noises. Makes words more plainly understood. An efficient substitute for Ruptured or Destroyed Ear Drums. **Immediate Results.**

Illustrated Booklet on Request

THE MEGA-EAR-PHONE, 407 Otis Bldg. Dept. S.I.-7, 16th & Samson Sts., Phila., Pa.

Insure your copy reaching you each month. Subscribe to SCIENCE AND INVENTION—$2.50 a year. Experimenter Publishing Co., Inc., 230 Fifth Avenue, New York City.

We looked upon a mighty whirlpool miles upon miles wide. It was swept with surges whose racing crests were smiting incandescences. It was threaded with spindrift of lightnings. It was trodden by dervish mists of flame thrust through with forests of lances of living light. It cast a cadent spray high to the heavens.

Over it those heavens glittered as though they were a shield held by fearful gods. Through the maelstrom staggered a mountainous bulk, like a leviathan of pale blue metal caught in the cratered tide of some volcano. A huge ark of metal breasting a deluge of flame.

And the drumming we had heard as of hollow beaten metal worlds, the shouting tempests of cannonading, was the breaking of these incandescent crests, the rolling of the lightning spindrift, the rhythmic impact of the lanced rays upon this glimmering mountain, reeling and trembling as they struck it.

The reeling mountain was—the City!

It was the mass of the Metal Horde itself, guarded by and stormed by, its own legions. It was the Metal Horde tearing, rending, fighting for, battling against—itself.

Mile high, as when I had first beheld it, was the colossal bulk that held the great heart of the cones; that held too the smaller hearts of the lesser cones, the workshops, the birth chamber and manifold other mysteries unguessed and unseen. But by a full fourth its base had been shrunken.

Ranged in double line along the side turned toward us were hundreds of Shapes that in their immensity bore down upon and oppressed the consciousness with a nightmare weight.

Rectangular, upon their outlines no spike of pyramid, no curve of globe showing, uncompromisingly ponderous, they upthrust. Upon the tops of the first rank were enormous masses, sledge shaped—like those metal fists that had battered down the walls of Cherkis's city, but to them as the human hand is to the paw of the dinosaur. As though the tower of the Woolworth Building in New York should be drawn up to twice its height, be widened by a half, be multiplied by hundreds, and then upon their tops be set horizontally, as hammer heads, towers a third as great.

Animate, flexible, they beat down with their prodigious mallets, smashing them from side to side. Behind them stood a second row, high as they and as angular. From them extended scores of girdered arms. These were thickly studded with the flaming cruciform shapes, the opened cubes gleaming with their angry flares of reds and smoky yellows. From the tentacles of many swung immense shields like those which ringed the great hall of the cones.

And as the sledges beat down, over them poured from the crosses a flood of crimson lightnings. Out of the concave depths of the shields whipped lashes of blinding flame. With ropes of fire they knouted those opposing shapes that the sledges smote and the sullen crimson levins blasted.

Now I could see the shapes that attacked. Grotesque, spined and tusked, spiked and antlered, wenned and breasted, they strove against the sledge-headed, smiting, multi-armed and blasting square towers.

High as they and as huge as they, in dozens of shifting forms they battled.

Spheres and pyramids against the cubes!

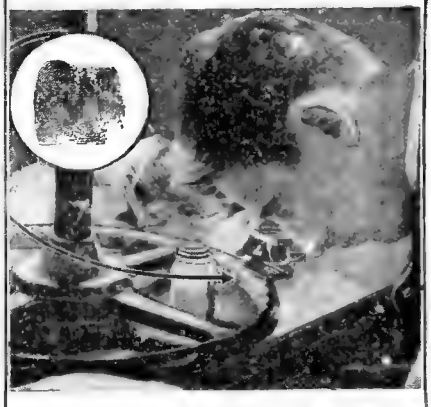
More than a mile from the stumbling City they stood ranged like sharpshooters, a host of bristling-legged pillars. Upon their tops spun gigantic, flashing wheels. Out of the centers of these wheels shot radiant lances, hosts of spears of intense violet light. The radiance they volleyed was not continuous, the javelined rays shot out in rhythmic flights, each flying fast upon the shafts of the others.

And it was their impact that sent forth the thunderous drumming. They struck and

How FINGER PRINTS Got HICKMAN!

Barlow Taking Hickman's Finger Print After Capture

You know the hideous tale—little Marion Parker kidnapped, foully murdered, her torn, mutilated body stuffed in a suitcase—delivered to her grief-stricken father for ransom—and the fiend drives off into the night—lost, unnamed, unknown—safe but for FINGER PRINTS! Yes, these telltale marks *cleared the mystery* surrounding this crime of unprecedented brutality and absolutely *identified* William Edward Hickman as the fiendish murderer. Fame and rewards go to the Finger Print Expert in this case. Fame and rewards await you, too, if you learn Finger Printing!



Barlow Discovers Hickman's Finger Print on Steering Wheel

Barlow Does Great Work!

If was Sergeant H. L. Barlow, Finger Print Expert of the Los Angeles Police Department who, after working continuously for 72 hours with intense concentration, forged link by link the finger print evidence which indisputably identified the ghoulish murderer as William Edward Hickman and made his actual capture only a matter of time. Today Barlow is famous the world over as a master Finger Print Expert! **You can become a Finger Print Expert, too! Easily—Quickly—at Home!**

FREE BARLOW'S OWN STORY!

We will send you Sergeant Barlow's *own story*—the inside story of this great case—absolutely FREE. Barlow's rewards for this alone may amount to $25,000.00! Think of it! How would YOU like to be a Finger Print Expert, unravel gripping mysteries, enjoy national fame and win big rewards? Mail coupon now and learn how you CAN become a Finger Print Expert, quickly, easily at home by mail—during your spare moments. Sergeant Barlow endorses the University of Applied Science. Get his own story free. Mail coupon NOW!

University of Applied Science,
1922 Sunnyside Ave., Dept. B-142 Chicago

Gentlemen: Please rush me by return mail Sergeant Barlow's own story of the Hickman case and tell me how I may learn the science of Finger Printing! No obligation on my part.

Name.....

Address.....

Did You Go to High School?

If not, here is your chance to get your education in spare time at home

It's EASY now to make up for the High School Education you missed. Fifteen wonderful books that you will enjoy reading in spare moments teach you every subject covered in the regular four-year course. Certificate awarded.

JUST READ FASCINATING QUESTIONS AND ANSWERS

It's *fun* getting your High School Education this way. You learn by the question and answer method—most interesting and effective teaching method known. All these subjects included: English, Latin, Ancient, Modern and American History, Geography, Physiography, Literature, Biology, Physics, Arithmetic, Algebra, Spelling, Civics, and Economics.

SEND NO MONEY

Examine these fifteen books FREE. No money in advance. Pay nothing on delivery. Keep the books 5 days. Then decide. Return them if you choose. Otherwise send $3.85 first payment and $1 monthly for 4 months—total only $19.85. Send name and address NOW.

High School Home Study Bureau
Dept. x-247, 31 Union Square, New York, N. Y.

FREE BOOK

For You—Just what you want. Get it before you buy. Crammed full of up-to-date offers at **Bargain Prices**—Lowest anywhere. Everything is high grade, perfect. **No "Seconds"!** Our goods are of the kind that last and please all the while.

60 Pages 4000 Offers—Everything you could think of

Send TODAY

→YOU Need It

Quick—compare our quality and prices with others—"We save you one-third to one-half"—you pay us less than many plumbers pay their jobbers. You can "Be Your Own Plumber"—easy to do your own installing. Free Book tells how. 60 pages, 4000 offers and sizes—everything in

Plumbing—Heating—Tinning—Paint

Such as Bathtubs, Lavatories, Closets, Sinks, Laundry Tubs, Water Heaters, Range Boilers, Water Supply Systems, Pumps, Tanks, Pipe, Sewage Disposal Systems—Furnaces, Steam and Hot Water Heating Plants—Parts, Fittings, Tools, Accessories, Supplies—Paint, Varnishes—and on hand also Fencing, Roofing, Tinning—**anything you want** all at **cut prices**—over 1,000,000 items—largest stock and variety in U.S. Some articles on **Easy Payments**—anything on **Open Account** if a business and rated. **Satisfaction Guaranteed.** In answering will you kindly add if you can the name of one or more persons who want a set goods in our line? Thank you. **Write for Book Today—NOW!**

BURKE & BROS. Dept. 1657 433 Liberty Ave. PITTSBURGH, PA.

MEN TO LEARN
MOTION PICTURE PROJECTION
A BIG-MONEY PROFESSION—$2,000 TO $4,000
We Assist Students to Earn While Learning
MOVIE OPERATORS SCHOOL
61 Sproat Street Detroit, Michigan

pierced and splintered against the walls. Gouts of molten flame dropped down these walls. The City's side bled fire.

With the crashing of broadsides of massed batteries the sledges smashed down upon the besieger. Under the impact globes and pyramids were shattered into blazing fragments, rocket-bursts of blue and azure and violet flame, flames rainbowed and irised.

The hammer ends split, flew apart, and were scattered. They became falling showers of yellow and scarlet meteors. But always other cubes swarmed out, repairing the broken smiting tips. And always where a tusked and cornute shape had been battered down and disintegrated, another arose, as huge and as formidable, pouring forth upon the squared tower its lightnings, tearing at it with colossal spiked and hooked claws, beating at it with incredible spiked and globular fists that were like the clenched hands of some metal Atlas.

As the striving shapes swayed and wrestled, gave way or thrust forward, staggered or fell, so too the City stumbled and swayed, advanced and retreated.

Unceasingly, the hail of radiant lances poured from the spinning wheels.

There arose a prodigious wailing, an unearthly, thin screaming. About the bases of the defenders flashed blinding bursts of incandescence, like those which had heralded the flight of the Flying Thing dropping before Norhala's house. Unlike them, they held no dazzling sapphire brilliancies. They were ochreous, suffused with vermillion. From the fountains of gushing light leaped thousands of gigantic square pillars, unimaginable projectiles hurled from the flaming mouths of titanic mortars.

They soared high, then swerved and swooped upon the lance-throwers. Beneath their onslaught those chimerae tottered. Living projectiles and living targets fused where they met, were melted and welded in mists of lightnings.

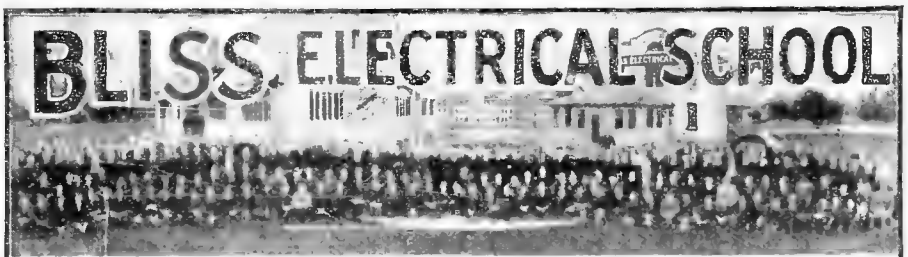
But not all. There were those that tore great gaps in the horned giants, wounds that instantly were healed with globes and pyramids seething out from the Cyclopean trunk. Ever the projectiles flashed and flew as though from some inexhaustible store; and ever uprose that prodigious barrage against the smiting rays.

Now from the ranks of the besiegers soared clouds of horned dragons, immense cylinders of clustered spheres studded with the clinging tetrahedrons. They aimed themselves, and they struck the cubed projectiles head on.

Bristling dragon and hurtling pillar struck and fused, or burst with an intolerable flashing. They fell—cube and sphere and pyramid—some half opened, some fully, in a rain of disks, of stars, of huge flaming crosses.

And now I became aware that within the City a strife raged as colossal as this without. From it came a volcanic roaring

BLISS ELECTRICAL SCHOOL



A special technical school with concise but comprehensive course in Electrical Engineering designed to be completed in ONE COLLEGE YEAR. Non-essentials eliminated. Thorough knowledge of underlying principles emphasized. Theory and practice are closely interwoven in class-room and laboratory.

ELECTRICAL ENGINEERING

The course is designed for earnest, ambitious young men of limited time and means. Curriculum includes mathematics, mechanical drawing and intensive shop work. Students construct motors, install wiring, test electrical machines. Graduates are qualified to enter the electrical field at once.

Bliss men hold responsible positions throughout the world. Thoroughly equipped fireproof dormitories, dining hall, laboratories and shops. **Prepare for your profession in the most interesting city in the world.** School established 1893. Catalog on request. Address

BLISS ELECTRICAL SCHOOL, 147 Takoma Avenue Washington, D. C.

THE NATIONAL SUCCESS COURSE

PRICE ~~$24.00~~

Now $1.98

24 Individual Lessons

A Necessary Guide to Business and Personal Efficiency

We have arranged to procure this valuable course for the readers of our magazine at the phenomenally low price of $1.98. There are twenty-four full, complete lessons, treating all of the necessary points required for a successful business career and for personal efficiency—This course is an absolute requirement to any aspirant to business success.

The following are the subjects treated:

Part
1. How to Get the Best Results
2. First Steps in Business Efficiency
3. How to do Business with Banks
4. The Principles of Business Achievement
5. How to Write Business Letters
6. How to Easily Develop Your Memory
7. How to Advertise Successfully
8. The Power of Right Thought
9. How to Make a Favorable Impression
10. How to Become a Successful Salesman
11. How to Prepare Sales Talks
12. How and Where to Find Customers
13. Your Health and How to Improve It
14. Psychology of Advertising and Salesmanship
15. Managing Men for More Profit
16. The Factors of Success in Business Building
17. The Money Value of System
18. How to Close Sales Successfully
19. How to Collect Money
20. How to Make Yourself Invaluable in Your Position
21. Premium and Sales Plans to Increase Business
22. A System of Accounts for Retail Merchants
23. Fundamentals of a Cost System for Manufacturers
24. Points of Law Everyone Should Know

SEND NO MONEY

Pay the Postman $1.98 plus a few cents postage

CONSRAD CO.
230 Fifth Ave. New York, N. Y.

CONSRAD COMPANY
230 Fifth Ave., New York, N. Y.
Gentlemen: Send me your NATIONAL SUCCESS COURSE. I will pay the postman $1.98 plus a few cents postage.

Name.....

Address.....

City.....State....

Build and Fly a 3-Ft. Model of
LINDBERGH'S
"Spirit of St. Louis"

Plans for Model Airplanes 25c per set
New York Paris Plane. FOKKER North Pole Plane, CURTISS JN4D 2 Biplane, DeHAVILAND Biplane, NC 4 Naval Seaplane, Bleriot-Taube or Nieuport Monoplanes, Cecil Peoli Racer.

This IDEAL New York Paris Monoplane is a perfect copy, 3 ft. size, of the machine in which Lindbergh crossed the Atlantic Ocean. Any bright boy can build this model: The IDEAL Construction Outfit contains everything needed: all parts, fittings, materials and supplies, including careful instructions, plans and diagrams. The model is wonderful; has many features of the original and is guaranteed to fly. Complete Construction Outfit $7.50
(West of Denver, Colo., and in Canada, price is $8.00)
Ask your dealer or order direct.

New 64-page Book of Model Airplanes
Teaches the principles of flying; contains plans and directions for building gliders and racers, and full information about scale Models of real planes; also most complete catalog of materials for model builders. Sent postpaid for **5c**

Ideal Aeroplane & Supply Co., Inc.
22-24 West 19th St. New York City

100 POWER MICROSCOPE
Study wonders of insect, plant, other unseen worlds. Invaluable to Boy Scouts and experimenters. No toy, but a real instrument with imported lenses and mirror, complete in case **$4.50**

250 POWER MICROSCOPE
Laboratory type, for Physicists, Dentists, Doctors, and general professional work. Has quick adjustment by knurled nuts both sides of tube. Special device protects slides from breakage. Triple divisible objective gives different powers and large clear field of great depth. Square stage with Clips. Adjustable Iris diaphragm, with plane and convex mirrors. Adjustable stand. A precision microscope complete with handsome case. **$16.50**

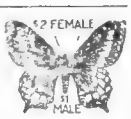
Catalog Free
Apparatus Engineering Co.
Dept. A, 342 Madison Ave
New York City

BULLY Revolver LIGHTER
Something Different!!
An exact reproduction of a small automatic revolver. Pull the trigger and you have a light instantly—works every time. Very easily operated—fits vest pocket. Gun metal finish with ring at bottom for chain. Makes an ideal gift.

Send No Money Just name and address. Pay postman only $1.79 plus postage. Satisfaction GUARANTEED or Money Back.
$1.79 Reg. $5 Value
ESTON MANUFACTURING CO.,
P. O. Box 633-N, Birmingham, Ala.

I Positively Guarantee
to increase your arms one-half inch in size, chest one full inch, strength 25%, health 100% in one week's time, by following my instructions and using my exerciser 10 minutes mornings and at night. Send $1 for complete course and exercisers. Satisfaction guaranteed or $1 refunded.
PROF. J. A. DRYER
Box 1850-L Chicago, Ill.

WHY NOT spend Spring, Summer, Fall gathering butterflies, insects. I buy hundreds of kinds for collections. Some worth $1 to $7. Simple work with my Instructions, pictures, price list. Send 10c (NOT STAMPS) for my Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. *41* Box 1424, San Diego, Calif.



In the wall of the City appeared a shining crack, from top to bottom it ran. It widened into a rift from which a flood of radiance gushed. Out of this rift poured a torrent of horned globes.

The rift closed upon them, catching those still emerging in a vise. It crunched them. Plain through the turmoil came a dreadful bursting roar.

Down from the closing jaws of the vise dripped a stream of fragments that flashed and flickered—and died. In the wall was now no trace of breach.

A hurricane of radiant lances swept it. Under them a mile wide section of that living scarp split away and dropped like an avalanche. Its fall revealed great spaces, huge vaults and chambers filled with warring lightnings. Out from them bellowed thunders. Swiftly, from each side of the gap, a metal curtaining of the cubes swept and joined them. Again the wall was whole.

I turned my eyes from the City, and swept them over the valley. Everywhere, in towers, in writhing coils, in whipping flails, in waves that smote and crashed, in countless forms, the Metal Horde battled. Here were columned isles against which metal billows rushed and were broken; here were metal comets that met and crashed high above the mad turmoil.

From streaming silent veil to veil—north and south, east and west, the Horde was slaying itself beneath the tempests of its lightnings.

The tortured hulk of the City lurched and swept toward us. Before it blotted the Pit from our eyes I saw that the crystal spans upon the river of jade were gone, and that the wondrous jeweled ribbons of its banks were broken.

Closer came the reeling City. I fumbled for my lenses and focused them upon it. Now I saw that where the radiant lances struck they—killed. The blocks blackened under them and became lusterless. The sparkling of the tiny eyes—went out. The metal carapaces crumbled.

Down dropped the bristling shapes that wrestled with the squared towers. They rose again in a single monstrous wave to overwhelm them. Before they could strike the City had swept closer and had hidden them from me.

Again I raised the glasses. They brought the metal scarp not fifty feet away. Within it the hosts of tiny eyes glittered, no longer mocking nor malicious. Insane!

Nearer drew the City—nearer.

A thousand feet away it checked its movement, and seemed to draw itself together. Then like the roar of a falling world the whole side facing us slid down to the valley's floor.

Hundreds of feet through must have been the fallen mass—within it who knows what chambers filled with mysteries? Yes, thousands of feet thick it must have been, for the debris of it splintered and splashed to the very edge of the ledge on which we crouched, and heaped it with dimming fragments of the bodies that had formed it.

We looked into a thousand vaults, a thousand spaces. There came another avalanche roaring.

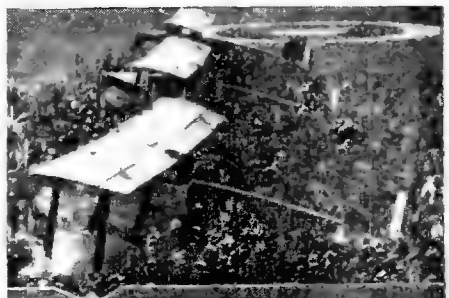
Before us opened the crater of the cones.

Through the torn gap I saw them, clustering undisturbed about the base of that one slender, coroneted spire, rising serene and unshaken from the lightnings. But the shields that had rimmed the crater were gone.

Ventnor snatched the glasses, and held them to his eyes.

"God!" I read his lips though I could not hear the words. "Look!"

Though the glass, the great hall leaped into full view apparently only a few yards away. It was a caldron of chameleon flame. It seethed with the Horde battling over the remaining walls and the floor. But around the crystal base of the cones was an open zone into which none broke.



Are You Hungry For Adventure... Popularity... Big Pay?

THEN CHOOSE AVIATION!

ARE you a red-blooded, daring he-man? Do you crave adventure, popularity, admiration, and the applause of great crowds? Then why not get into the Aviation Industry—the greatest adventure since time began—the greatest thrill ever offered to man?

Think what Aviation offers you. The praise and plaudits of the multitude. And a chance to get in on the ground floor where rewards will be unlimited! Aviation is growing so swiftly that one can hardly keep track of all the astonishing new developments. Air-mail routes have just been extended to form a vast aerial network over the entire U. S. Many Commercial Airlines and airplane factories are now being organized. Men like Henry Ford are investing millions in the future of commercial Aviation for they see its great possibilities.

Easy to Get Into Aviation By This Home Study Method

Get into this thrilling profession at once while the field is new and uncrowded. Now — by a unique new plan—you can quickly secure the basic and preparatory training at home, in spare time. Experts will teach you the secrets and fundamentals of Practical Aviation—give you all the inside facts that are essential to your success. And, the study of Aviation by this remarkable method is almost as fascinating as the actual work itself.

PICK YOUR JOB!
Flying
Airplane Instructor
Airplane Engineer
Airplane Repairman
Airplane Assembler
Airplane Mechanician
Airplane Inspector
Airplane Builder
Airplane Salesman
Exhibition Manager
Airplane Contractor
Airplane Motor Expert
Airplane Designer

Send for FREE Book!
Send coupon for our new free book, just out—*Opportunities in the Airplane Industry*. It is vitally interesting, reads like a romance and tells you things about this astonishing profession you never even dreamed of. Write for your copy today.

AMERICAN SCHOOL OF AVIATION
3601 Michigan Ave., Dept. 142-B Chicago

AMERICAN SCHOOL OF AVIATION
3601 Michigan Ave., Dept. 142-B Chicago, Ill.
Without obligation, please send me your FREE book, *Opportunities in the Airplane Industry*. Also information about your Home Study Course in Practical Aviation.

Name _____ *Age* _____
Address _____
City _____ *State* _____

RUSH-Absolutely FREE

"The World's most Useful small tool" and the "$5 000" PlieRench Circular without obligation to me.

Name.....
R. F. D. St.....
P. O. City.....
☐ Am interested in Factory Repr. Proposition.

---CLIP HERE---

Mail to THE FLASH SALES CORP'N
SI-7-4809 N. Ashland Ave. CHICAGO, ILL.

FREE to First 1,000 Readers mailing above Coupon—an E-F ANGLE Screwdriver—

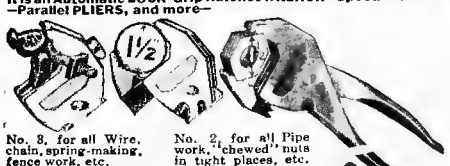
Of tempered crucible Spring steel, it has 7 powerful driving edges for large and small screws and 101 other uses—works under obstructions where others won't. Carries like small pocket knife—more often useful and valuable.

Also FREE—the "$5,000" Circular—giving amazing 125-Picture story of—

The Pocket Machine Shop!

—with its 1-Ton Power-Gear, it Outgrips a 40-Pound Vise!

The "hand-grip" of a tiny Rubber band holds a Bearing Ball—the Hardest-to-hold thing known—against a 300-Pound Pull!
It is an Automatic LOCK-Grip Ratchet WRENCH—Speed VISE—Parallel PLIERS, and more—



No. 3, for all Wire, chain, spring-making, fence work, etc. No. 2, for all Pipe work, "chewed" nuts in tight places, etc.
No. 1, Universal—for ALL pliers, Nut Wrench, Vise and clamp, Spring-making Work, etc.

EIFEL-FLASH PLIERENCH KIT

You get the amazingly Quicker, Better, Easier, Universal Tool Service of Nos. 1, 2 & 3—CONVERTIBLE IN 1-5 SECOND—in this New 24-Ounce Master Tool Kit—for the PRICE OF ONE GOOD TOOL; yet, it Does the Work of the best other tools Weighing 60 pounds and Costing $50.00!

HUNDREDS OF THOUSANDS of Men and Women are using these wonder Kits to make their Homes and Estates more comfortable—FARMS, Shops, etc., more profitable; to get more and better service from Automobiles and all mechanical devices; with an enormous saving in money, time and energy! Used by the U. S. Army and Navy. JUST TRY a PlieRench KIT ONCE, and you would no more go back to other tools than you would to the ancient Ox-cart!

If interested in Permanent Income of $75 to $200 Weekly—as Factory Representative (Full or part time) MARK COUPON!

With each Kit is a 64-page Manual of Mechanics.
A GUARANTEED SUPER-QUALITY PRODUCT

Mail the Valuable Coupon above—NOW!

CHEMISTRY

Complete, practical home-study courses prepared by some of the best-known chemists in this country, including ALLEN ROGERS, B.S., M.S., Ph.D.—Head of Department of Industrial Chemistry, Pratt Institute; L. M. TOLMAN, Ph.D., Vice-president, United Chemical and Organic Products Co.; BRADLEY STOUGHTON, B.S.—Head of the Department of Metallurgy, Lehigh University, and OWEN L. SHINN, Ph.D.—Professor of Applied Chemistry, University of Pennsylvania.

Mail Coupon for Free Booklet

INTERNATIONAL SCHOOL OF CHEMISTRY
Division of the
International Correspondence Schools
Box 6241-E, Scranton, Penna.
Without cost or obligation, please send me full details of your home-study course in

☐ Analytical Chemistry ☐ Metallurgical Chemistry
☐ Chemical Engineering ☐ Short Chemistry Course
☐ Industrial Chemistry ☐ Pharmacy

Name .....
Address .....

Write Like This

Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. No failures. Complete outline FREE. Perfect Penmanship Inst., Dept. 44, St. Louis, Mo.

LE PAGE'S GLUE Handiest Tool in Your Workshop
In bottles, tubes and cans

In that wide ring, girdling the shimmering structure like a circled sanctuary, were but three forms. One was the wondrous Disc of jeweled fires I have called the Metal Emperor. The second was the sullen fired cruciform shape of the Keeper.

The third was Norhala!

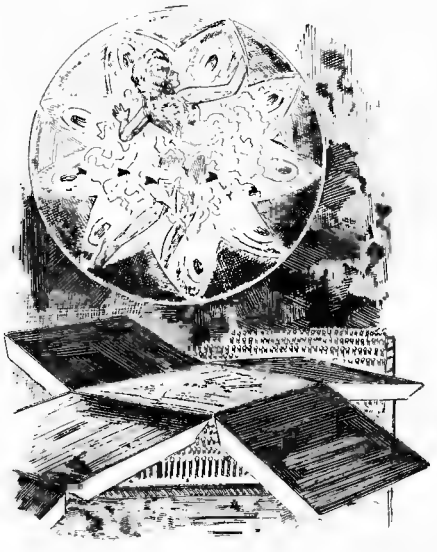
She stood at the side of that weird master of hers—or was it after all the lover? Between them and the Keeper's planes gleamed the tablet of countless rods which controlled the activities of the cones.

Plain was Norhala—so close that almost it seemed, I could reach out and touch her. Her hair streamed and billowed, her face was a mask of wrath and despair. Her great eyes blazed upon the Keeper. Her exquisite body was bare, stripped of every shred of silken covering.

From streaming tresses to white feet an oval of pulsing golden light nimbused her.

For all their stillness, their immobility, it came to me that Emperor and Keeper were at grapple, locked in death grip. Clearly too it came to me that in this duel was epitomized all the vast conflict that raged around them.

But with what unknown powers was that duel being fought? Disc and Cross cast no lightnings. They battled with no visible



Her body writhed as though it shared the agony of the Shape that held her. Her head twisted. The great eyes, pools of uncomprehending, unbelieving horror, stared into mine. With a spasmodic, infinitely dreadful movement the Disc closed—and closed upon her—

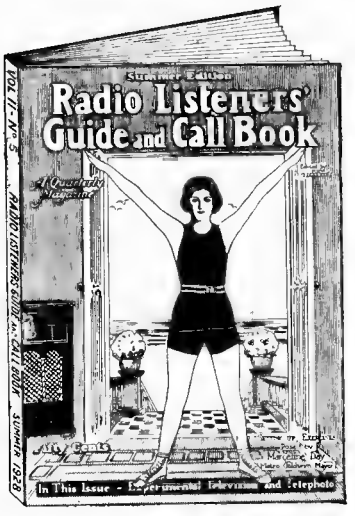
weapons. Only the great planes of the Keeper of the Cones smoked and smoldered with their sullen flares of ochres and of scarlets, while over all the face of the Metal Emperor the cold and irised fires raced and shone, beating with a rhythm incredibly rapid. Its core of incandescent ruby blazed. Its sapphire ovals were pools of living, lucent radiance.

There was a splitting roar arising above the clamor, deafening us even in the shelter of the veils of silence. On each side of the crater, masses of the City dropped away. Fleetingly I was aware of scores of smaller pits from which uprose lesser replicas of the Coned Mount, lesser hives of the Horde's energy.

Neither Emperor nor Keeper moved.

I strained forward, to the very thinnest edge of the curtainings. Between Disc and Cross was forming a fine black mist. It hung like a black shroud. It was transparent, spun of minute translucent ebon corpuscles. It shook and wavered now toward Emperor, now toward Keeper of the Cones.

READ--



RADIO-LISTENERS' GUIDE AND CALL BOOK

Timely Articles for the RADIO ENTHUSIASTS

TELEVISION and TELEPHOTO are every day demanding more and more attention from those interested in the developments of the radio world. The RADIO LISTENERS' GUIDE and CALL BOOK, in keeping with its policy of giving its readers only such information as is of current interest, is featuring in the new summer issue an article on each of these remarkable developments.

Mr. Lloyd Jacquet, well-known editor and radio engineer, has written a most interesting, enlightening article on TELEPHOTO. Every phase of this modern wonder-apparatus is thoroughly explained, and there are complete instructions for building an experimental TELEPHOTO outfit.

Possibly the greatest marvel of this advanced age is TELEVISION—the transmitting of actual moving scenes through the air. This engrossing subject is dealt with in a most attractive fashion by Mr. A. P. Peck, a man well-known in the radio world both as radio technician and editor. Mr. Peck, in this tremendously interesting article, has covered every question concerning TELEVISION in a clear, concise manner. A feature of this article is the diagrams and lucid constructional information for making an efficient TELEVISION apparatus for use in experimental work.

Don't miss this big Summer Edition of *Radio Listeners' Guide and Call Book*. 176 pages, fully illustrated, replete with diagrams and drawings. Every worthwhile new development in radio can be found in its pages. The complete, accurate, and up-to-date log is a necessity in every radio home.

THE **50c** COPY

AT ALL NEWSSTANDS OR WRITE DIRECT

CONSRAD COMPANY
230 Fifth Avenue, New York, N. Y.

CONSRAD COMPANY
230 Fifth Ave., New York, N. Y.
Gentlemen: Enclosed please find 50c, for which send me a copy of the new Summer Edition of RADIO LISTENERS' GUIDE and CALL BOOK

Name .....
Address .....
City ..... State.....

$25.00 Drawing Course for $2.98

Haven't you often wished that you could draw cartoons, illustrate some idea, sketch some pretty face, etc ? You can do all of these things. One of America's most famous Cartoonists and illustrators has developed a great, simple system for success in all branches of Commercial Art. This system has revolutionized the entire theory of drawing. It means that drawing can be as easy for you as writing—much simpler than learning shorthand, bookkeeping or typewriting. We are now placing this original system for learning Drawing, Art and Cartooning, consisting of 34 lessons with over 500 illustrations, within reach of every one. If you will devote a few hours each week to the Course WE ABSOLUTELY GUARANTEE that you will learn to draw and draw well before you have half finished the Course. If we fail to make this claim good we will refund every cent paid us. By eliminating a large office force for answering correspondence, expensive catalogs, etc., we are enabled to make a price of $2.98, the cheapest price ever known for a high-grade home study course. Many have sent us letters similar to that of Rob't P. Davis of Detroit, who wrote: "I can't see how you ask so little, when others with inferior Courses get from $20 to $60 for theirs. It is more than I expected." Learn to draw. It is a big asset, no matter what field you are in.

Send No Money

Just order the Course, and on arrival pay postman $2.98 plus a few cents postage payment in full for the entire Course and Free Drawing Outfit. If not entirely satisfied, return within five days and we will REFUND MONEY. Address—

FREE: If you order the Course at once we will include a drawing outfit, consisting of artist's pencils, pens, paper, erasers, thumb tacks, etc., enabling you to go to work without any additional cost.

LEDERER SCHOOL OF DRAWING, Dept. 9296-W
Chattanooga, Tenn.

Orders from outside the U.S.A. are payable $3.28 cash with order.

Orders-Inquiries

POLK'S REFERENCE BOOK and Mailing List Catalog

Gives counts and prices on over 8,000 different lines of business. No matter what your business, in this book you will find the number of your prospective customers listed. Valuable information is also given as to how you can use the mails to secure orders and inquiries for your products or services.

Write for Your FREE Copy
R. L. POLK & CO., Detroit, Mich.
Largest City Directory Publishers in the World
Mailing Lists—Business Statistics
Producers of Direct Mail Advertising

ENJOY the THRILL of ELECTRIFIED RADIO at SMALL COST

only $6.85 complete
FREE TRIAL

Banish forever all the annoyance and expense of buying new "B" Batteries with a TOWNSEND "B" POWER UNIT. Hooked up in a few moments—and you have permanent power from your light socket from that time on. Use same tubes now in your set. No changes.

You'll be amazed at the way Townsends improve your reception and add to distance getting. More than 50,000 now in use. Send Coupon today for full information and free trial offer.

TOWNSEND LABORATORIES
Chicago Illinois

—COUPON—

TOWNSEND LABORATORIES
Dept. 35, 713 Townsend St., Chicago, Ill.
Please send me full information on the Townsend "B" Power and Free Trial Offer.

Name .....

Address .....

I sensed a keying up of force within the two, and knew that each was striving to cast that hanging mist upon the other like a net.

Abruptly the Disc flashed forth, blindingly. As though caught upon a blast the black shroud flew toward the Cross and enveloped it! And as the mist covered and clung the Cross's flares dimmed. They were snuffed out.

The Keeper fell!

Upon Norhala's face flamed wild triumph. The outstretched planes of the Keeper swept up as though in torment. Its fires flared and licked through the clinging blackness. It writhed half upright. It threw itself forward. It crashed down prostrate upon the tablet which only its tentacles could manipulate.

From Norhala's face the triumph fled. On its heels rushed stark, incredulous horror.

The cones shuddered. From them came a single mighty throb of force—like a prodigious heart beat. Under that pulse the Disc staggered, spun—and, spinning, swept Norhala from her feet and swung her close to its flashing rose. A second mightier throb pulsed from the Cones.

A spasm shook the Disc—a paroxysm. Its fires faded; then flared out again, bathing the floating, unearthly figure of Norhala with their iridescences.

Her body writhed as though it shared the agony of the Shape that held her. Her head twisted. The great eyes, pools of incomprehending, unbelieving horror, stared into mine—

With a spasmodic, infinitely dreadful movement the Disc closed—and closed upon her—

Norhala was gone was shut within it!

She was crushed to the pent fires of its crystal heart!

I felt Ruth's body strike against me, and bend in a convulsive arc. She dropped.

(To be continued)

SECOND SERIAL RIGHTS

MODEL DEPARTMENT BLUEPRINTS

Correct—Easy to Follow

1–2	Horizontal Steam Engine details ..... set	$1.00
3–4	Boiler construction for above ..... set	$1.00
5	880 Ton Bark.....	50c
6–7	Twin Cylinder Steam Engine and Boiler. set	$1.00
8–9	Gasoline Fired Locomotive ..... set	$2.00
10–11	U. S. S. Constitution, "Old Ironsides".. set	$1.00
12	13th Century Man-of-War	50c
13–14	Chinese Junk ..... set	50c
15–16	Electrically driven Automobile ..... set	$1.00
17–18	How to Build a Reflecting Telescope ..	$1.00
19	Roman Ballista	50c
20–21	Simple Steam Engine, set	50c
22	"Santa Maria," complete	50c
23–24	Model U. S. S. Portsmouth ..... set	$1.00
25	Building a Model Tugboat	50c
26	Twin Cylinder Marine Engine	50c
27–31	U. S. S. Truxton.....	$2.00

Send Orders to

MODEL DEPARTMENT
SCIENCE AND INVENTION
230 Fifth Avenue
New York City

Oh You Skinny!

ARE YOU LAUGHED AT ON THE BEACH?

STRONGFORT
Builder of Men

Are you a puny, boney, skinny outfit at whom everybody laughs? Are you a curiosity on the beach, inviting all sorts of ridicule? Do girls titter as you pass them? Do they shun your society? If this is your sorry plight, young fellow, just take a hunch from me—snap out of your skinniness—put on flesh and muscle, build up strength and straighten up your back. YOU CAN DO IT. You can be a duplicate of that bronzed and much admired lifeguard over whom the girls rave. You can develop a symmetrical form, rounded out chest, rippling muscles on your arms and legs. You can be a powerful swimmer, a graceful dancer, a peppy boxer, a swift runner—just what you'd like to be.

Let STRONGFORT Make a Man of You

I've taken thousands of young fellows, skinny as a lath and built them up into strapping, powerful men who commanded respect and admiration wherever they went. Some of these chaps had set too fast a pace for themselves, others had wasted their vitality and broken down their manhood, others had gone stale from neglect of their bodies or other abuses and excesses. No matter how despondent their state of mind or how physically broken they were, they quickly came back when they adopted

STRONGFORTISM

The Science of Health and Strength

STRONGFORTISM works wonders with run-down, weakly, skinny men. It builds them up to health through internal muscular development, then rounds them out into robust physical specimens by bringing into play every muscle and making every muscle do its work as Nature intended. You'll be astonished how quickly you'll feel the benefits of this best of all health and strength Courses. You'll feel like a new man almost from the first day you start under my instructions. You'll be surprised at the lazy muscles you wake-up when you begin, and they'll wake you up in turn. You'll quickly realize that a new day has dawned for you as you feel the red blood coursing through your whole body like a bounding mountain stream. That old, stupid, sluggish feeling will disappear like magic. That gloomy outlook will vanish as though a heavenly hand had brushed it away. Oh, it's a great feeling! Great to feel like a man! And you surely will when you adopt Strongfort as your instructor and guide—Strongfort, "the builder of men."

I Want to Send You MY FREE BOOK

This book of many pages and dozens of pictures tells of my wonderful experience—how I became the outstanding athlete of the world, performing feats others dared not attempt, how I turned the knowledge gained through developing my own body to the benefit of others, and then how STRONGFORTISM was evolved. It tells what I have done for others, what I can do for you. It doesn't mince words. It tells plain truths. "Promotion and Conservation of Health, Strength and Mental Energy," points the way from disease and weakness to health and strength. It is priceless. I'll send it to you on request—FREE. Write for your copy today.

LIONEL STRONGFORT
Physical and Health Specialist for over 25 Years
Dept. 486 Newark, N. J., U. S. A.

Send This FREE Consultation Coupon
ABSOLUTELY CONFIDENTIAL

Mr. Lionel Strongfort,
Strongfort Institute, Dept. 486, Newark, N. J.
Please send me absolutely free my copy of your book, "PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY."
I have marked (x) before the subjects in which I am most interested.

. Catarrh	. Overweight	. Great Strength
. Colds	. Constipation	. Vital Losses
. Asthma	. Weak Back	. Lung Troubles
. Headache	. Weak Eyes	. Round Shoulders
. Rupture	. Rheumatism	. Youthful Errors
. Thinness	. Nervousness	. Manhood Restored
. Pimples	Night Losses	Stomach Disorders
. Insomnia	. Short Breath	. Increased Height
. Impotency	. Weak Heart	. MuscularDevelopm't

Private Ailments .....
Name.....
Age..... Occupation .....
Street .....
City..... State.....

High School Course in 2 Years

This simplified, complete High School Course—specially prepared for home study by leading professors—meets all requirements for entrance to college, business, and leading professions.

20 Other Courses

Over 200 noted Engineers, Business Men, and Educators helped prepare the special instruction which you need for success. No matter what your inclinations may be, you can't hope to succeed without specialized training. Let us give you the practical training you need.

American School
Drexel Ave. & 58th Street
Dept. HB-294 Chicago

Money Back When You Finish If Not Satisfied

American School, Dept HB-294 Drexel Ave. and 58th St., Chicago
Send me full information on the subject checked and how you will help me win success in that line.

.....Architect	.....Electrical Engineer
.....Building Contractor	.....General Education
.....Automobile Engineer	..... Lawyer
.....Civil Engineer	.....Mach. Shop Practice
.....Structural Engineer	.....Mechanical Engineer
.....Business Manager	.....Steam Engineer
.....C. P. A. & Auditor	.....Sanitary & Heating
.....Bookkeeper	.....Surveyor & Mapping
.....Draftsman & Designer	.....High School Graduate

Name.....

Address .....

You
Learn Quickly with a Conn

CONN instruments are world-famous for easy playing. Improved, simplified mechanism. Perfect scale. Beautiful tone. New easy instruction methods, fun from the start. Play a tune in an hour on the Conn saxophone!

FREE TRIAL; EASY Payments on any Conn. Organize a band or orchestra in your community! Conn arranges all details. Send the coupon.

CONN BAND INSTRUMENTS

C. G. Conn, *Ltd.*, 756 Conn Bldg., Elkhart, Ind. Please send details of trial offer on.....(Instrument)
Name.....
St. or R.F.D.....
City.....
State, County.....
Check here if interested in organizing a band [ ]

A CHANCE TO START YOUR OWN BUSINESS
Either Full Time or Spare Time AS OUR REPRESENTATIVE

Making Metal Toys and Novelties, a new industry in America, offers you great opportunity for Big Profits. Demand exceeds supply for Toy Soldiers, Animals, 5c. and 10c. Store Specialties, Ash Trays, Auto Radiator Ornaments, etc. We co-operate with you in selling goods you make, also buy them from you. Small investment puts you on Road to Success. WE FURNISH COMPLETE OUTFITS AND START YOU IN WELL-PAYING BUSINESS. Absolutely NO experience necessary and no special place needed. A chance of a lifetime for man with small capital. ACT AT ONCE! If you want to handle Big Wholesale orders now being placed Write for free catalog and full information.

METAL CAST PRODUCTS CO.
Dept. E. 1696 Boston Road New York

BUILD YOUR OWN CLOCK WITH OUR HELP

Turn idle hours into welcome dollars building clocks. Very profitable spare time work. We furnish plans, instructions, works, dials, and all materials at low prices.

Banjo Clocks, Mantel Clocks
Works As Low As $1.65
Grandfather Clocks with Chimes
Ask for our attractive FREE Blueprint Plan and Catalog

AMERICAN CHIME CLOCK CO.
Dept. G, 1679 Ruffner Street, Philadelphia, Pa.

SQUAB BOOK FREE

Breed squabs and make money. Sold by millions. Write at once for free 40-page book beautifully printed in colors telling how to do it. *You will be surprised.* PLYMOUTH ROCK SQUAB CO.
506 H St., Melrose Highlands, Mass.

Recording Your Own Pulse

By DR. A. GRADENWITZ

(*Continued from page* 221)

actual practice. The following comparison, derived from radio engineering will serve to illustrate this: Supposing several broadcast receiving sets to be tuned, say, to wavelengths of 520, 515, 510, 505, 500, 595 and 490 meters, respectively, on a receiving circuit tuned to Berlin's standard wave length of 505 meters will respond to the waves coming from Berlin, all the remaining being quiet. In fact, a series of such receiving circuits will enable the length of waves emitted by any given radio station, i. e., their frequency, to be found out.

The "pulse wave" receiver or indicator is a series of minute pendulums tuned to variable frequencies and hung up around the circumference of a disc in the field of an electro-magnet. The exciter coil is placed in the center and a dry cell battery of the type used in electric pocket lamps is enclosed in the socket. This serves to excite the magnet coil at rhythmic intervals, merely by having the pulse, through a contact device, close the electric circuit.

The contact device serving to control the circuit in accordance with the pulse rhythm is fixed to the wrist by means of a rubber band. It mainly comprises a small frame and two contact levers arranged to turn around pivots in the frame. The lower or primary level and contact plate is applied to the pulse itself and is moved up and down by the same. It carries at its end a minute window made of platinum wire on the one side and of some insulating material on the other. The second lever, penetrates through the window and moves with very little play, being carried along by the primary lever and touching the metallic and insulating sides of the frame alternately as this goes up and down. The contact device is connected to the indicator by a flexible shaft.

As the exciter circuit is opened and closed by the rhythmic movement of the pulse, the pendulums will, for short intervals, receive a magnetic impulse and thus be made to perform oscillations of variable amplitudes. The pendulum happening to be in resonance with the pulse rhythm will have the largest amplitude, though even some of the remaining pendulums, viz., those close to it, will be set moving. If, for instance, the pendulum tuned to 80 pulse-beats per minute, is made to perform a maximum deflection, even the 78, 76, 74 and 72 pendulums will partly share in this movement, whereas the 82, 84, etc., pendulums will be either immobile or reduced to very slight fluctuations. This should make visual reading of the instrument particularly easy.

Fig. 1 is a schematical view illustrating the functioning of the apparatus. *A* is the pulse control contact between the primary and secondary levers, *D* the dry cell battery, *S* the exciter coil of the magnet core *W*, and *M* one of the 24 pendulums hung up with *F*, *K*. *C* is the conductor supplying the current, *E* the wrist, *B* the point of maximum pulse motion.

Apart from this most simple type of apparatus which is destined for visual reading and which can readily be carried by the fingers of one hand, there has been developed a more elaborate type which records the pulse automatically and which would seem to be particularly suited for purposes of diagnosis and analysis. This apparatus comprises the same fixture attached to the wrist and, facing the 24 small pendulums, a set of 24 contacts insulated from one another and which are arranged at such distances apart as to be touched only by pendulums performing a maximum deflection. One of

(*Continued on page* 285)

Learn **ALL ABOUT TELEVISION**

Television is becoming more and more popular every day. Get in on the ground floor. Remember it was just a few years ago that Radio was going through the same stages of development that Television is today. It is the experimenters of the old "fan" days that are now reaping the rewards of the "successful" in the radio field and, in Television there is the same chance for success—the same field for experimentation that Radio afforded. Those who come out on top of this infant industry will be the ones who, realizing its possibilities grow with it. Television will undoubtedly attain the proportions, as an industry, that radio enjoys today. This is your opportunity—it knocks but once—take advantage of it. Send for the book "Television" written by accepted authorities on the subject.

BUILD AN EXPERIMENTAL TELEVISION SET

Build yourself an experimental Television set. In "TELEVISION" you will find complete information for the construction of an experimental outfit. Every phase in the construction and development of Television is fully and comprehensively explained. Mail this coupon today. Don't wait! Over 112 pages—fully illustrated—large magazine size.

At All Newsstands or Write Direct

THE **50¢** COPY

EXPERIMENTER PUBLISHING CO.
230 FIFTH AVENUE, NEW YORK, N. Y.

EXPERIMENTER PUBLISHING CO.
230 Fifth Ave., New York, N. Y.

Gentlemen: Kindly send me a copy of "TELEVISION." Enclosed find 50 cents.

Name .....

Address .....

City ..... State.....

MONEY-MAKING DEPARTMENT

Make $120 weekly. Experience unnecessary. Take orders for Camden Suits—tailored-to-measure, $28.75. Extra pants Free. Pure wool fabrics, wonderful tailoring. Your profit $4.50 in advance. Satisfaction or money back. Write today for Free Outfit. Camden Clothes, Inc., Dept. 207, Chicago.

$100 weekly, just demonstrating! New marvelous guaranteed Kitchen Device, needed everywhere. Approved by Good Housekeeping Institute. Your pay in advance. Write for sales outfit. Central States Mfg. Co., Dept. H-2011, 4500 Mary Ave., St. Louis, Mo.

Paint agents wanted by old-established company. Binding guarantee given with paint. Liberal commission. Write O. L. Chase Paint Co., St. Louis, Mo., Dept. 75.

Punchboard Salesmen. New fascinating game. Exeltement; legal all states; $200 weekly easy; one minute sales talk; pay daily. Cigar-Stores Novelty Co., Dept. P., Peoria, Ill.

Genuine DuPont Fabrikoid Tablecloths. No laundering—Wash like oilcloth—Look like imported Linen. $75 weekly—Pay daily—Sample book free. Dollette Corp., 1018 Wabash, Chicago.

Tailoring Salesmen sell all-wool made-to-measure Suits, Overcoats, $24.50, one price. Established line. Successful over 30 years. Great Western Tailoring Co., Dept. 201, Chicago.

Represent factory—selling direct guaranteed perfect fitting auto seat covers, folding outdoor furniture, $8.50 automatic clothes washer, beats competition. Largest commissions. $400–$125 weekly. Outfit free. Supreme, 1243-S Wabash, Chicago.

Agents $240 month. Bonus besides. Sell finest line silk hosiery. Beats store prices. Guaranteed to wear 6 months or replaced. Auto furnished. Write for samples. Wilknit Hosiery Co., Dept. 1835, Greenfield, Ohio.

Big Money Daily. We offer large com-mission paid every day, exclusive territory, free samples and an unlimited future to local representatives distributing to banks, business, professional and society people America's most widely known lines of Made-to-Order Personal and Business Christmas Greeting Cards, Stationery, Announcements, etc. The Process Engraving Co., Inc., Sample Dept., Troy at 21st Street, Chicago.

Tailoring Salesmen—Sell Simpson's new $23.50 pure virgin-wool Union made-to-measure suits and overcoats; commissions in advance; exclusive territory; big outfit. 175 samples free. J. B. Simpson, 843 Adams, Dept. 1500, Chicago.

$5.00 to $15.00 daily selling Parmode Dresses. Wonderful values—easy to sell—highest commissions! Write today. Parmode Co., 5037 Waterman St., St. Louis, Mo.

Agents—Sell ladies finest line full-fashioned silk hosiery; underwear. No experience needed. Spare; full time. Samples free. Advanced commission and bonus. Mills Hosiery Corp., 366 Fifth Avenue, New York.

Man of good appearance, personality. Special sales work; Resident at least 3 years. Position pays about $35 week to start. Robert Harvey, Box L, Chicago.

Write for free sample amazing new ten-in-one kitchen utensil. Broiler, eggpoacher, toaster, no-burn kettle bottom, etc. Sells on sight for 50c. You make 100% profit. Send 25c for postage on your sample. We refund 50c if you return it. Be sure to mention this magazine. Alfred Carroll, 554-B Argyle Rd., B'klyn, N. Y.

Be a Real Estate Expert. $5,000-$15,000 yearly. Experience unnecessary. I'll teach you everything. Connect you with my chain of real estate experts. Write for FREE booklet. National Real Estate Institute, Dept. 500-M, Fort Smith, Ark.

Thrills—Mystery—Romance—greatest offer made. Eleven pocket-size books, exciting, gripping stories. Bargain offer extraordinary. While they last, only 50c for complete set. Fisher Printing Co., 796 Kearney, Arlington, N. J.

Business of your own! Make $68.00 a week and up. We furnish everything. Sell all wool made-to-measure suits direct from factory. $23.75. It's easy—real $45.00 values. No experience needed. Advertising and sales training course furnished. Write Fairbanks Tailoring Co., 2303 Wabansia Ave., Chicago, Ill.

Every headache pays you profit. Millions use Aspirin. Agents can make $500 month on new 5 cent Aspirin Plan. Write Chas. M. Hick, 1020 S. Wabash Ave., Chicago.

Amazing new dishwasher does the dishes, scrapes the pans, washes bottles in half the time, with half the effort. Sensational demonstrator. Amazes housewives. Low priced. Every home an order. $90 weekly easy. Also 47 other money-making rubber specialties. Free outfit. Write quick. Kristee Mfg. Co., 84 Bar St., Akron, Ohio.

Death lurks behind glaring headlights! Amazing invention ends headlight terror, and makes night driving a pleasure. Salesmen coining money. Big season now. Write quick. Lee-See Co., Dept. A, Kewaunee, Wis.

Make $12 a day and liberal bonus selling Pioneer $23.50 and $33.50 all-wool tailoring. Commissions paid daily. 100 extra large cloth samples furnished. We train the inexperienced. Write Pioneer Tailoring Co., Congress & Throop, Dept. U1272, Chicago.

107 Men Wanted for Open Territories. Top-Notch pay demonstrating famous Kriss-Kross Stropper in your home locality. Hopkins (Mich.) made $20 first day. It's easy—we show you how. $75 weekly simple as A B C. Get details quick. Write Rhodes Corp., Dept. H-3252, 1418 Pendleton Ave., St. Louis, Mo.

M. H. Rhodes, Dept. H3252,
1418 Pendleton, St. Louis, Mo.
Am interested in your proposition. Rush details.

Name.....

Address.....

Marcelwaver Is Taking American Women by storm. Men and women representatives everywhere making biggest profits of years. $279 a week—$57 a day—$17 an hour—spare or full time workers earn such amounts easily. Territories now being allotted. Full information Free. Marcelwaver, Dept. 98H, Cincinnati, Ohio.

Represent Old Established Firm, selling All Wool Tailored to Individual Measure Suits $23.50—$29.50. Commissions $4.00–$5.00. Your Big Opportunity! Outfit Free! Write General Tailoring Co., 527 S. Franklin, Chicago.

Tired of Working for other people? Without experience, training or capital I'll show you how you can become financially independent. Easy, Pleasant work. $100 profit every week. Free automobile. Write today for particulars. Albert Mills, Manager, 1922 Monmouth, Cincinnati, Ohio.

Agents—$60 week—Dri-Kleanit makes any car look like new. Removes mud, grease, tar, all one operation. No soap or water used. Free sample. American Accessories Co., Desk 635, Cincinnati, Ohio.

No Canvassing from House-to-House— Make $10 daily, full or spare time, acting as our District Sales Manager. A dignified, respectable, good-paying position open to honest, reliable men and women. Write for details. No obligation. Badger Company, Fort Atkinson, Wisconsin.

Steamship Positions — Men — Women. Good pay. See the world. Free. Experience unnecessary. Send self-addressed envelope for list. Box 122-R, Mount Vernon, N. Y.

Men! $7.50 an hour spare time. Bargain all-wool stylish suits tailored-to-measure at $18.75. Sell every man! $3.75 advance commission for you. Write for expensive sample case—it's Free! Canterbury Tailors, Dept X-10, 20 West 22nd Street, New York.

Not An Ordinary Offer! Weekly Income about $55.00 a week to live agents. Introduce unbreakable fountain pen at half price. Write for Free Plan. Or quicker, send $2.00 for Sample Pen worth $8.00. Act today! Bonded Reservoir Pen, Dept. 507, 147 Nassau Street, New York City.

New invention prevents shoulder straps slipping. Earn $60 up weekly. Selling experience unnecessary. Women adore this amazing comfort chain. Free sample offer. Lingerie "V" Co., 97 Oak St., North Windham, Conn.

Are you ambitious? 250 positions open for agents and direct salesmen. Next 3 big issues of my book containing amazing opportunities and valuable secrets on how to make extra money sent for only 10 cents. Phil. Bernard, 22 E. Twelfth St., Cincinnati, Ohio.

Start a Crispette Shoppe. Delightful confections. Everybody likes them. Make a lot of money. We start you. Write, Long Eakins, 687 High St., Springfield, Ohio. (Samples 10 cents.)

Get Our Free Sample Case-Toilet Ar-ticles, Perfumes and Specialties. Wonderfully profitable. La Derma Co., Dept. RC, St. Louis, Missouri.

Amazing invention mends socks, shirts, and thousand other articles. Banishes darning, sewing. 50% to 200% profit. Free equipment. New-Way Laboratories, 11th St., Mt. Healthy, O.

America's Greatest Tailoring Line Free! 130 large Swatch Samples—All Wool—Tailored to Order—Union Made—Sensational low price. Get outfit at once. Address Dept. 427, Goodwear, 844 W. Adams, Chicago.

Business Success: Complete National Success Course we offer to you at the amazingly low price of $1.98. Previously sold for $24.00. Every subject on business and personal efficiency treated. Pay postman $1.98 plus a few cents postage on delivery. Consrad Co., 230 Fifth Avenue, New York City, N.Y. Desk A.

Wavy Hair in 10 minutes. "Waveen" new wonder preparation changes straightest hair into lustrous, soft waves. Sensation of New York. Be your own hairdresser. Absolutely greaseless and harmless. Large bottle sent postpaid on receipt of $1.00. Beauty Co., 365 G Lincoln Place, Brooklyn, N. Y.

Money—Do you need it? New illustrated book gives 67 tested plans to make spare-time money without investment. Mail 50c to V. O. Fisher, 795 Kearney, Arlington, N. J.

Are You The Man—
Big money made by Armstrong District Tailoring Salesmen. Greatest suit values in America. $22.50 all-wool tailored-to-measure. $4.00 commission. 125 samples. Money-back guarantee. Write quick for exclusive territory and details. Wm. Armstrong Co., 2306 Wabansia, Chicago.

We Start You Without A Dollar, Soaps, Extracts, Perfumes—Toilet Goods, experience unnecessary. Carnation Co. Dept. 593, St. Louis, Mo.

Men—Sell new line of advertising pen-cils. Wonderful opportunity to build up a permanent business. Liberal commission. Write now. Central Pencil Co., 443 Broome St., N. Y.

You can't earn money if your feet hurt. Nature-Treads give instant relief. Write for particulars, free. Nature-Treads, 655 So. Wells St., Chicago, Illinois.

Writers' Magazine sent three months for 25 cents. Tells secrets of writing and selling stories, articles, poems, songs, etc. Writers' Digest, Dept. X, 22 E. 12th St., Cincinnati, O.

Biggest cash in advance commissions—bonus—selling Roy all-wool made-to-measure suits. Popular prices. Superb Fall line ready. Roy Tailors, Desk A, Cincinnati.

Why not sell us your spare time? $2.00 an hour, $19.70 daily easy full time. Introduce 12 months Guaranteed Hosiery—47 styles, 39 colors, for men, women, children, including latest "Silk to the Top" Ladies' Hose. No capital or experience needed. We furnish samples. Silk hose for your own use FREE. New Plan. Macochee Hosiery Co., Park 9287, Cincinnati, O.

SQUARE-DEAL ADVERTISERS ONLY

If you do business on the basis of "satisfaction or money back" write us for rates in this and other magazines.

Publishers Classified Service,
9 East 46th St., New York

World's leading manufacturer of Fire Extinguishers has positions open for salesmen in direct selling, capable of earning $3,600 to $6,000 yearly. Prospects everywhere—easy sales. We train you. Rapid promotions to producers. Fyr-Fyter Co., 1697 Fyr-Fyter Bldg., Dayton, Ohio.

$100 weekly selling better-quality, all-wool, made-to-measure suits and overcoats at $23.50. Highest commissions. Extra bonus for producers. Large swatch samples free. W. Z. Gibson, Inc., 500 Throop St., Dept. U-672, Chicago, Illinois.

Polmet Polishing Cloth. — Cleans all metals, gets enthusiastic attention, sells fast at 25c; sample free. F. C. Gale Co., 99 Edinboro St., Boston, Mass.

$25.00 daily selling colored Raincoats and Slickers, Red, Blue, Green, etc., $2.95. Hat Free. Pay daily. Outfit Free. Elliott Bradley, 230 S. Wells, Dept. AF-7, Chicago.

Bankrupt and Rummage Sales. Make $50 daily. We start you, furnishing everything. Permanent business. Free details. Distributors, Dept. 279, 429 W. Superior, Chicago.

New Way to Make Money and get your own clothes Free, taking orders for our fine made-to-measure tailoring. Write today for new style outfit, all wool samples, etc. Furnished free. Progress Tailoring Co., Dept. U-372, Chicago.

Agents earn big money taking orders for our beautiful Dress Goods, Silks, Wash Fabrics, Hosiery, Fancy Goods, 1000 Samples furnished. The National Importing Co., Dept. G89, 573 Broadway, New York City.

Distributor. 100 store route this county; experience unnecessary; no selling, distribute and collect; should net $70 weekly. Perls Manufacturing Company, Box 173, Florin, Pa.

Agents—We start you in business and help you succeed. No capital or experience needed. Spare or full time. You can earn $50–$100 weekly. Write Madison Products, 566 Broadway, New York, N. Y.

Agents—Just Out! $8.88 for Men's Suits! Anyone can sell! Commission $3 in advance! Free Sales Kit! The 888 Company, Dept. G-15, Fort Wayne, Ind.

Foreign Positions—Men interested going romantic South America write us. Good pay. Expenses paid. South America Service Bureau, 14,600 Alma, Detroit, Mich.

Get Free Demonstrating Outfit—Smart-est Mary Rose Frocks, most wonderful values. Experience unnecessary. $5 to $10 daily. Rodasi Co., 465 Rodasi Bldg., Cincinnati, Ohio.

If I show you an all Virgin Wool Suit, tailored-to-order, valued at $35, that you can sell for $22.50, make $4.00 yourself, give you absolutely Free, Complete selling outfit, will you give my proposition a trial? P. C. King, 2238 South La Salle, Chicago, Ill.

Big Pay Every Day! Complete guaran-teed line direct to wearer—Dress Shirts, Work Shirts, Overalls, Coveralls, Work Pants, Sweaters, Underwear, Playsuits. $10–$15 daily; experience unnecessary. Big outfit FREE! Nimrod Co., Dept. 58, 4922-28 Lincoln Ave., Chicago.

Agents—New lines just out. Everything in hosiery, lingerie and underwear for men, women, children. Beautiful, irresistible Catalog and Samples now ready. Two new special big-money plans. Cash bonus, service awards. No capital needed. Choice territories going. Write quick. World's Star Knitting Company, 140 Lake St., Bay City, Michigan.

Auto Owners Get $10 for Old Tires. Free to agents heavy-duty, 7 ply new Mellinger tire, guaranteed 15 months and big sales outfit. Write Mellinger Tire Co., Dept. 6, Kansas City, Mo., Warren, Ohio, Oakland, Calif.

Sell $19.75 All-Wool Suits—Regular $35 values. Make $4.00–$5.00 each sale—$100 per week easy. Big 9x13 samples and complete outfit Free. No experience required. Write now. Howard Tailoring, 200 S. Peoria, Chicago.

Highest grade American and European importations made-to-order by the finest tailoring company in America. Salesmen wanted to take orders from well-dressed men. Elaborate sales equipment furnished. Either 9 by 13 swatches or 1¼ yard samples. Six price ranges. Commissions $5.00 to $10.00 on each suit (plus bonus). Write today. Hamilton Tailoring Co., Dept. 22, Cincinnati, Ohio.

Now! $5,000 year easy! Sell Gibraltar Shirts! Finest quality. Lowest prices. Defy competition! Liberal daily commissions. Send today for free outfit containing large assortment shirt samples. Gibraltar Shirt Co., Dept. U-7, 20 West 22nd Street, New York.

Agents $240 month. Sell finest line silk hosiery you ever saw. We furnish auto. Free silk hosiery for your own use. Write today for samples and state size of hose worn. Betterknit Textile Co., Silk 1435, Greenfield, Ohio.

Wow, what a money-maker! Sell Naso made-to-measure pants, $5.95 (2 pairs, $11.00; commission $2.00). New line ready. Naso Co., Dept B, Cincinnati, Ohio.

LEARN WHILE YOU EARN

The National Home Study Council of Washington, D. C. has investigated the Home Study Schools whose ads. marked with a star (★) appear in this column. These schools are recommended on the following grounds:

Truthful promises, thoroughness of courses, capable instructors, and reasonable instruction fees. These institutions are worthy of your confidence.

★ **Learn electricity at home through com-**plete, practical courses written by well-known electrical engineers. Indorsed by Edison and Steinmetz. Write for Free Booklet. INTERNATIONAL CORRESPONDENCE SCHOOLS, Dept 1226-C, Scranton, Penna.

★ **Test Your Art Ability Free. Send now** for Art Questionnaire which tests your drawing ability, sense of color, etc. Learn Commercial Art at home in spare time. Federal students making $2,000–$6,000 yearly. Give age, occupation. Federal Schools, Inc., 60 Federal Schools Building, Minneapolis, Minn. (Member National Home Study Council.)

★ **Hotels Need Trained Executives. Nation-**wide demand for trained men and women; past experience unnecessary. We train you by mail and put you in touch with big opportunities. Write at once for particulars. Lewis Hotel Training Schools, Suite AX-W637, Washington, D. C.

★ **Avoid those embarrassing mistakes in** English by studying at home in spare time. New method shows you instinctively which word to use and how to use it. Write for Free Booklet. INTERNATIONAL CORRESPONDENCE SCHOOLS, Dpt. 1225-C, Scranton, Pa.

★ **Men qualify Forest Ranger Position;** start $125 month; cabin and vacation. Patrol the forests; protect the game. Write Mokane Institute, Dept. M-44, Denver, Colo.

★ **Manufacturing Industries demanding** thousands of trained Foremen, Superintendents and Factory Managers. Big Pay. We train you at home in spare time and put you in touch with positions. Send for free 32-page book which explains fully. Lincoln Extension University, Inc., Dept. E-1, Cleveland, Ohio.

★ **Want U. S. Gov't Position; commence** $115-$250 month? Men-women, 18-55, trained at home in three weeks. Write Ozment's Instruction Bureau, 137, St. Louis, Mo.

★ **Big Opportunities! Learn at home—** Movie Photography, Portrait, Commercial or News Photography, or start own business. Write for Catalog 111. New York Institute of Photography, 10 W. 33rd St., New York City.

★ **Men, get Forest Ranger job; $125-$200** month and home furnished; hunt, fish, trap. For details, write Norton Institute, 1523 Temple Court, Denver, Colo.

★ **Big Pay Electrical Jobs open everywhere.** $60 to $100 a week easy. Learn at home in spare time. Start making extra money at once. Training endorsed by Engineers Assn., and employers. Working outfit and Job Service furnished. Small down payment starts you. Money back if not satisfied. Send no money now. Investigate first. Write L. L. Cooke, Chief Engineer, 2138 Lawrence Ave., Chicago.

New Low Price Bargain SALE!

Send NO Money

SOLID gold effect case guaranteed 25 years. Accuracy guaranteed by 100 year old Million Dollar Factory. Richly engraved Locomotive crown, timekeeper dial, railroad back. Why pay $10 or $15 for your next watch? Order now during Bargain Sale, Only $3.87 and postage.

Send NO Money

Send postal and pay when your watch arrives.

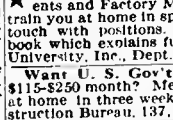
FREE TRIAL. Wear 10 days at our expense. Money back if not delighted.

BRADLEY, 44 F, NEWTON, MASS.

FREE Gold Bond Guarantee

LUCK $ Money, Happiness Success all symbolized in this rich, new "LUCKY-MAGNET" ring. Attracts, compels, mystifies! **Be RICH!** Win at games, business, love. *Order yours now!* **SEND NO MONEY.** Pay postman on arrival. Postage paid. Guaranteed. $2.98

BRADLEY, 44 L, NEWTON, MASS.



LUCK Mystic Mirror Ring—said to reflect GOOD LUCK; success in Love and great Riches for the wearer! "Magic Crystal" top—attracts, compels, mystifies! Be Rich! Win at games, business, love.

SEND NO MONEY—Pay $1.98 and postage on arrival. Money back if not delighted.

BRADLEY, 44 Z, NEWTON, MASS.

THESE 2 MAGAZINES *for* THE PRICE OF 1

Science and Invention and Radio News

THESE two popular magazines for the price of RADIO NEWS alone. This big money-saving offer should be tremendously interesting to every reader of SCIENCE AND INVENTION. If you are interested in its contents, you are sure to be just as interested in that of RADIO NEWS. RADIO NEWS is the leading magazine of radio. Every worth-while development can be found somewhere within its pages. New circuits—what to build—discoveries—your favorite announcer or broadcaster—these are just a few of the many interesting topics relating to radio that you will find fully covered in each issue of RADIO NEWS.

To the readers of SCIENCE AND INVENTION we need say nothing. What SCIENCE AND INVENTION is and on what it treats is made apparent by a glance through these pages. This tells better than mere words just how much really valuable information is contained in each issue.

Both RADIO NEWS and SCIENCE AND INVENTION sell for 25c the copy, or three dollars a year (newsstand subscription rate). By this special offer you will be able to get both of these popular magazines for practically the price of one—$3.50 for one year's subscription to both. Take advantage of this tremendous saving. Fill in the coupon below.

EACH MAGAZINE OVER 100 PAGES —
LARGE SIZE—FULLY ILLUSTRATED

MAIL THE COUPON NOW

EXPERIMENTER PUBLISHING CO.
230 Fifth Ave., New York, N. Y.

EXPERIMENTER PUBLISHING COMPANY,
230 Fifth Ave., New York, N. Y.

Gentlemen: I wish to take advantage of your big money-saving subscription offer. Enclosed find check or money order (check which) for $3.50. Kindly send me Radio News and Science and Invention for one year beginning with the next issue.

Name .....

Address .....

City ..... State .....

NEWAY LACQUER SPRAY

SMOOTHER AND SWIFTER THAN BRUSHING

Type "B" Complete **$3.45**

For the easy and practical application of lacquer paints (Duco). A smooth, durable, glossy finish assured. Paint and refinish automobiles, furniture, screens, radiators, machinery, etc. Unlimited uses in any home, garage, paint shop.

Well designed and built. Adjustable atomizing head affords a continuous spray. Useful for spraying oils, insecticides, etc.

Type "B"—as shown—complete with 1½" heavy duty pump, 8 ft. tubing—New Way dual top for use on either metal or glass containers. Glass furnished as standard-$3.45. Type "B"—less foot pump. For your pump or air supply—$2.25. Type "A"—Attached hand pump. Dual top. Easily cleaned glass container assures visibility. The sturdiest and finest hand spray—$1.95.

Method of using Type "A" **$1.95**

Type "C" Complete **$7.95**

Type "C" De Luxe. Complete with large auxiliary pressure tank and moisture trap. Requires only an occasional stroke of pump. A professional outfit for shops, farms and homes where large surfaces are to be sprayed. No experience necessary to operate. Heavy duty 1½" pump, pressure gauge on tank, shutoff valve, 10 ft. hose, New Way dual top and glass container—$7.95

Type "C"—Tank, pump and gauge only—$4.75.

Extra Glass or Metal Tanks with Air Tight Tops for Keeping Lacquers and Liquids Handy for Use 25c

Send 10 cents postage for 3000-word booklet, "How To Do Lacquer"

NEW WAY SPRAY GUN COMPANY
Dept. T-7 5511 Euclid Avenue Cleveland, Ohio
Headquarters for Lacquer Spraying Equipment

A Challenge

USE YOUR WITS!

NEW—

Solve them if you can!

HERE are 116 pages of extraordinary puzzles.

Sam Loyd, the master puzzler, has devised a new set to try your mind.

Puzzles of all sorts, with a special 26-page section of scientific puzzles for the mechanic, the engineer or the man with a scientific trend of mind.

It is fine fun and excellent training for the mind.

Get the Book Now
Sam Loyd's Tricks and Puzzles

50c

On all Newsstands or Direct

EXPERIMENTER PUBLISHING CO.
230 FIFTH AVENUE NEW YORK, N. Y.

Recording Your Own Pulse

(*Continued from page 282*)

the 24 circuits is thus closed, the resulting current being supplied by means of a contact pulley to a paper tape unwound between rollers and conveyed along sheets of moistened paper. Moistening is effected automatically, the paper passing through a vessel filled with water. Having been prepared by suitable chemicals, the paper changes color as the current is sent through it.

Each recorded pulse beat appears on the paper tape in the form of a small stroke and the pulse curve is obtained by tracing the upper outline.

The nervous responsiveness to stimuli of any kind, for instance, the effect of drugs can be watched carefully on the record taken by the pulse resonator. A morbid condition, for instance, diseases of the heart, can be diagnosed and any constitutional heart defect detected at an early stage when no outside symptoms have as yet developed.

The apparatus will prove particularly useful with physiological and pharmacological work of any description, investigating the influence of work, fatigue, training, sleep, stimulants and the effect of physical and therapeutical treatments. Interesting results may be expected from its use for psychological tests and fitness trials, effects of ailments, alcohol, the influence of bodily fatigue, frightening, etc. In gauging a patient's blood pressure, a film showing the variable rhythm of the pulse should be added.

Camera-less Photography

By C. A. OLDROYD

(*Continued from page 237*)

With some subjects, the operator will have to discover the best way of dealing with them; crystals, for instance, can be printed in the followng manner.

Supposing we wish to make a print of hypo crystals, the substance widely used in photography. Dissolve some of the fixing salt in water, and pour a little of this solution on the center of the glass plate which fits in the printing frame.

Then place the plate near a radiator or fire, to evaporate the water; the plate must of course be kept horizontal or the solution will run off. In a few hours, the water will have evaporated, leaving a fine network of crystals on the glass plate.

This can be printed from in the usual way, but the side which carries the crystals must not come into contact with the printing paper; it must face the light. The exposure will be very much shorter than with denser subjects, and "hard" paper should be used to get a maximum of contrast.

The beauty of even the simplest objects, when nature-printed, will astonish you, and perfect records true to scale can be secured without a camera in very little time.

Radio Wrinkles Wanted!

The Radio Editor, Mr. Paul E. Welker, wants to hear from you, if you have a good idea or wrinkle. Make a pencil or pen and ink sketch of the contrivance, write 50 words or so of description, and mail to the Radio Editor, c/o this magazine.

5 Easy Ways to make $3.00 an hour in Your Spare Time in RADIO

REDUCE STATIC BY MARVELOUS NEW METHOD
ELECTRIFY OLD STYLE SETS
IMPROVE TONE AND VOLUME OF OL TS
MODERNIZE OLD SETS WITH ONE DIAL CONTROL
RADIO-FY & ELECTRIFY PHONOGRAPHS

JOIN the Radio Association and cash in on Radio now. Earn $75 a week spare time. Fit yourself for the big-pay opportunities in Radio.

JOIN THE

RADIO ASSOCIATION

Our members making big money by the "5 Easy Ways," building and installing sets, and serving as "radio doctors." The Association will train you to do the same, start you in business without capital, help increase your salary.

Write today for No-Cost Membership

To limited number we will give No-Cost Memberships. Write for details and copy of booklet, "Your Opportunity in the Radio Industry."

RADIO ASSOCIATION OF AMERICA
Dept. SN-7 4513 Ravenswood Ave., Chicago, Ill.

Win a NASH Sedan or $1400.00 in cash

Someone who answers this ad will receive, absolutely free, a fully equipped De Luxe Model Nash Sedan, or full value in cash if preferred ($1,085.00). In addition to this Nash Sedan we give away, absolutely free, a latest model Chevrolet Coach or its cash value ($595.00), a Brunswick Panatrope Phonograph, a Six Tube, Single Dial Freshman Radio, a Corona Portable Typewriter — many other valuable prizes and Hundreds of Dollars in Cash.

14	
1	
19	
8	

Solve This Puzzle

The numbers in the squares to the right spell two words. The alphabet is numbered. A is 1, B is 2, C is 3, etc. Can you make out what the two words are? When you do this, send me your answer right away. It may mean winning the Nash Sedan or $1,400.00 in cash.

19	
5	
4	
1	
14	

$315.00 Cash For Promptness

In addition to the two automobiles, the many other valuable prizes and Hundreds of Dollars in Cash, we are also offering a Special Prize of $315.00 in Cash for Promptness. First prize winner will receive $1,400.00 in cash, or the Nash Sedan and $315.00 in cash. In case of ties duplicate prizes will be awarded each one tying. Get busy right away. Solve the puzzle and send me your answer together with your name and address written plainly. EVERYBODY REWARDED. Address

M. L. BOEING, Dept. B379
323 So. Peoria St., Chicago, Ill.

$3.99 Lifetime Precision **Men's Strap Watch**

Worn by practical men everywhere. Guaranteed shock proof and weather proof. Perfect time keeper. Radium dial. Fine imported full jeweled movement. Rich silver finish. Genuine leather strap. Sold elsewhere for $10.00. Fully guaranteed to give you complete and entire satisfaction. SEND NO MONEY: Pay to your postman only $3.99 plus the postage on delivery.

JENKINS CORPORATION
621 Broadway, New York, Dept. 6S-F-7

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the September issue must reach us not later than July 5th.

EXPERIMENTER PUBLISHING CO., INC., 230 Fifth Avenue, New York, N. Y.

Advertising

Get into Advertising. Learn quickly at home. Experience unnecessary. New, easy plan. No text books used. Practical work. Old established school. Send name and address for interesting free booklet. Page-Davis School of Advertising, Dept. 533-B, 3601 Michigan, Chicago

Advertising Agencies

24 Words—355 Rural Weeklies $12.20. Ad-Meyer, 4112-SI Hartford, St. Louis, Mo

Agents Wanted

Agents, big profits selling stores 5c candy specialties. Colonial Co., a312 E. 33rd St., New York

Big Bunch Mail. Year 15c. Catalogues, magazines. Kentucky Agency, Covington, Kentucky

Make Money—Spare Time. Men, Women, Boys, Girls—Easiest Method—Absolutely something different—No Selling—No Canvassing—Free particulars. Federal—561D.D. Broadway, New York.

Men and Women Wanted to sell subscriptions in their own communities. Can make a dollar an hour in spare time. Two leading magazines. Help given to beginners. Write for information at once. Agency Dept., Experimenter Publishing Co., 230 Fifth Avenue, New York City.

Mirrors Resilvered at Home. Costs less than 5 cents per square foot; you charge 75 cents. Immense profits plating autoparts, reflectors, tableware, stoves, refinishing metalware, etc. Outfits furnished. Sprinkle, Plater, 955, Marion, Indiana.

Send name, address on postcard. Free Introductory copy Modern Salesology Magazine. 1000 money making opportunities offered by big reliable firms; no obligation Salesology Magazine, Desk B219, 500 No. Dearborn, Chicago.

Don't sell for others. Employ agents yourself. Make your own products. Toilet Articles, Household Specialties, etc. 500% profit. Valuable booklet free. National Scientific Laboratories, 1975W Broad, Richmond, Va.

Gold Leaf Window Letters and Script Signs. No experience; 500% profit. Samples free. Meyer writes 5 days profits $141.36. Consolidated, 69-R, West Van Buren, Chicago.

$50.00 Weekly easy, applying Gold Initials on Automobiles. No experience needed. $1.45 profit every $1.50 job. Free Samples. "Ralco Monograms," P1043, Washington, Boston, Mass.

Agents Wanted to sell Men's Hats direct from factory. Write for catalog. Model Hat Mfg. Co., Dept. M-11, East Orange, N. J.

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

New Invention—400% profit. Liquid quick mend for Fabrics and Hosiery. Stops runs. Every woman buys. Hundred other fast sellers. J. E. Johnson Co., Dept. 867, 6129 Wentworth Ave., Chicago.

Strange Invention! Pays $25 Daily. Keeps telephone and iron cords from tangling and kinking. Prevents iron scorching. Saves electricity. Samples free. Neverknot, Dept. 7-K, 4503 Ravenswood, Chicago.

Agents—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Philadelphia, Pa., Dept. 601.

$60—$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 71, East Orange, N. J.

Succeed With Your Own Products. Make them yourself. Formulas, Processes, Trade-Secrets. All lines. Catalog, Circulars free. D. Thaxly Co., Washington, D. C.

Airplanes, Aviation

Biggest, Best Catalog Model Airplanes, Parts, Supplies; 5c postpaid. Ideal Company, 23 West 18th Street, New York.

Model Airplane Engines: ½ h. p. in 3 lbs; 1 h. p. in 5 lbs. We buy patentable improvements in engines. Circulars free. DYNAMIC MFG. CO., First Nat'l Bank Bldg., Chicago.

Send dime for 12-inch mounted propeller and circular on free three-foot model aeroplane. No selling. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich

Build your own single seater airplane. Book and blueprints on design, construction, and lessons in flying all for $1.00. Chas. Russell, 545 Stadium Place, Ft. Wayne, Ind.

Books

Family Medical Practice. Diagnoses your ailment for you. Indispensable for home. Saves doctors' bills. Write for circular A. Mailwey Trading Co., 1034 N. Wilcox, Hollywood, Calif.

Books, Magazines, Art Publications in French, English, Spanish. Photo novelties, etc. Samples, lists, 20 cents in stamps. Villaverde Co., Dept. 206, Box 1329, Havana, Cuba.

Free. My Illustrated Circulars on Newthought, Selfculture, Healing, Yogi Philosophy, Occult, Mystic and Scientific Books. Martens Publisher, Inc., Burlington, Iowa.

Business Opportunities

$100 per month in your home folding and mailing circulars. Particulars and samples, 25 cents. Adams Mailing Service, Box 236, Bellwood, Pa.

Free Catalogue! Generous Commissions. Sell Cards and Stationery. Paxtang Printery, 321 Paxtang Ave., Harrisburg, Pennsylvania.

Practical Sparetime Money Making Ideas, 25c coin. State age, sex and occupation. Walter E. Adams, P. O. Box 53, Omaha, Neb.

Want to make a dollar an hour in your spare time? Send for full information, Agency Dept. Experimenter Publishing Co., 230 Fifth Ave., N. Y. C.

Sell By Mail!—Books, novelties, bargains; large profits! Particulars FREE! E-Elfco, 525 South Dearborn, Chicago.

Print 250 Signs or Pictures an hour without press, type or machinery. Sample and particulars 10c. Straco, 1015½ Springfield, Ohio.

Sell by Mail. Wonderful opportunity. Particulars free. Mason, 3902 Broadway, Dept. 9, Chicago.

Free Book. Start little Mail Order business, Hadwil, 54-71 Cortlandt Street, N. Y.

Cameras and Photography Supplies

Make money in Photography. Learn quickly at home. Spare or full time. New plan. Nothing like it. Experience unnecessary. American School of Photography, Dept. 5333, 3601 Michigan Avenue, Chicago.

Chalk Talks

Laugh producing program, $1.00. Catalog free. BALDA ART SERVICE, Dept. 4 Oshkosh, Wis

Chemistry

$4.00 Astounding Chemical Offer. Will ship prepaid anywhere in U. S. Chemical outfit consisting of 100 different expensive pure laboratory chemicals, including apparatus. Cash or C. O. D. Swimmer Chemical Co., 1500 St. Marks Ave., Brooklyn, N. Y.

Big Chemical Mail, 5c. Walker, 1514 Allison, Washington, D. C.

Catalogue listing 2500 illustrations laboratory apparatus 5,000 chemicals and 1,000 scientific books sent on receipt of 50c. Laboratory Materials Company, 635 E. 71st St., Chicago.

Attention Chemical Experimenters! 100 chemicals consisting of complete selection for the experimenter's laboratory. Chemicals of highest quality obtainable sufficient quantities for hundreds of experiments. Apparatus with this outfit to perform many experiments. Really ideal for any laboratory. Price $4.00. 50 pieces high grade chemical apparatus containing most essential equipment for laboratory. Worth three times price asked. Our price $7.00. Postage prepaid. Send money order or C. O. D. to Pines Chemical Co., 1521 St. Marks Ave., Brooklyn, New York.

(Chemistry continued)

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 195 of this issue. Chemical Institute of New York, 16 E. 30th St., New York City.

Your Chemical problems solved and working process furnished for Five Dollars. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

!!!!!—10c brings you "Amateur Chemist". Everyone likes it. Year, $1.00. Thompson-Allen Laboratories, Shamokin, Pa.

Correspondence Courses

Used correspondence school courses sold on repurchase basis. Also rented and exchanged. Money-back guarantee. Catalog free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Correspondence Stationery

200 Lettersheets and 100 Envelopes, $1.10, post paid Oberman Company, Box 1268, Chicago.

Detectives

Detectives Earn Big Money. Travel. Excellent opportunity. Make secret investigations. Great demand everywhere. Experience unnecessary. Write American Detective System, 2199 Broadway, N. Y.

Electricians and Helpers

Send Dollar Bill for Questions and Answers required by most states to obtain Electrician's License. Learn these and increase your electrical knowledge 500%. Hinman, 2938 Hancock W., Detroit, Mich.

Engines, Motors, Dynamos

Make Electric Motors—half and one horse-power. A. C. induction motor winding models show connections plain sight. Learn quick easy. Dept. C, Gaines Bros., Gainesville, Texas

Bargains—Motors, Machines, Washing Machine Motors, $5.55; ½ H.P., $17.50. Electric Drills, $14.75; Electric Grinders, $7.45. Farm Plant Motors, $3.45. Generators, $15.95; Electric Vacuum Cleaners, $8.95. 100 other bargains. Send for Bargain Bulletin No. 630. Acme Tool Co., 627 Washington Blvd., Chicago.

Female Help Wanted

$30 Weekly. Addressing and mailing cards. Experience unnecessary. Everything furnished, including postage. Sample and particulars 6c. Imperial Stationery Company, Desk 5, Greenfield, Ohio.

For Boys

"The Boy Electrician," pocket size, 75 illustrations. 30c. J. Tillberg, Proctor, Vermont.

For Inventors

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Inventors—We Build Models. Send us your rough idea. Our master mechanics will develop it for you into a practical working model. Thirty years successful experience doing this very thing. Best shop equipment. Expert advice. Confidential service guaranteed. Bank reference furnished. Send for free booklet, "The Road to Success." Crescent Tool Co., Dept. D, Cincinnati, Ohio.

Patents obtained under cooperative payment plan. Write for particulars. W. E. Beck (Registered Patent Lawyer), 953 Baltic Bldg., Washington, D. C.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 808 Baltic Bldg., Washington, D. C.

Inventors. Use our special service for presenting your invention or patent to manufacturers. Adam Fisher Mfg. Co., 205 A Enright, St. Louis, Mo.

Formulas

Tube puncture plugger, radiator cement, concentrated soft drinks, $1.50 each—all for $2.00. Lewis Laboratories, [illegible]

Formulas—170 Moneymakers and Big Illustrated Catalog 20c. Ideal Book Shop (D) Park Ridge, Ill.

Help Wanted

Men—Experience unnecessary; travel; make secret investigations; reports; salaries; expenses. Write American Foreign Detective Institute, 304, St. Louis, Mo.

Help Wanted Instructions

Earn $25 Weekly. Spare Time. Writing for Newspapers and Magazines. Experience unnecessary. Copyright Book, "How to Write for Pay" Free. Press Reporting Institute, 987, St. Louis, Mo.

Insects Wanted

Cash paid for butterflies, insects. See Sinclair's Advertisement on page 279.

Instruction

Mail Carriers—Clerks—Railway Postal Clerks. $158.00 to $225.00 month. Steady jobs. Men, 18-45. Sample coaching free. Write immediately. Franklin Institute, Dept. E15, Rochester, N. Y.

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 195 of this issue. Chemical Institute of New York, 16 E. 30th St., New York City.

Blueprints or photostats. Sail, steam or diesel yachts. Wonderful sport sedan. Country homes. To scale. Decorative and instructive. One for $1. Three for $2. Seven assorted for $5. Mention preferences. Money back if not satisfied. Edward Carroll, Box 473, Burlingame, Cal.

For Furniture Decoration Make Silhouettes of yourself, friends, pets, etc. Also signs, showcards. $1.00. Particulars for stamp. H M. Birr, 79 W. Ritterhouse, Battle Creek, Mich.

Play Original Chess surprisingly amusing. Patented rules. 60 cents in stamps. S. V. Niego, Box 1015, Alexandria, Egypt.

U. S. Government Jobs. Become Railway Postal Clerks. ($158-$225 month.) City Carriers—Postoffice Clerks. ($142-$192 month.) Rural Carriers. ($175-$255 month.) Men 18 up. Steady work. Life positions. Paid vacation. Common education sufficient. Experience unnecessary. Sample coaching and full particulars free. Write today sure. Franklin Institute, Dept. E. 4, Rochester, N. Y.

Want Government Forest Ranger Job, $125-$200 month? "How to Qualify." Free. Write, Ozment Inst. Bureau, 293, St. Louis, Mo.

Inventions Wanted

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Magic and Games

Free with $25 order our large die box. Send 20c for our large catalogue of tricks, puzzles, wigs, sensational escapes. Oaks Magical Co., Dept. 549, Oshkosh, Wis.

Be a Magician! Nine tricks you can do (worth $5.00) 50c coin. Vernon Lux, Rochelle, Ill.

Magical Goods

Card tricks, Coin tricks, Hypnotism, Ventriloquism. Instructive 64 page books, 10c each. G. Fenner, 2401 Jefferson, Louisville, Ky.

Male Help Wanted

Train for fireman, brakeman, baggageman, colored sleeping car, train porter. Standard roads, $150-$200. Experience unnecessary. 897 Railway Bureau, East St. Louis, Illinois.

Men—Big pay working romantic, wealthy South America. Fare, Expenses paid. South American Service, 14,000 Alma, Detroit, Mich.

Men, get **Forest Ranger** job; $125-$200 mo. and home furnished; hunt, fish, trap. For details, write Norton Inst., 1541 Temple Court, Denver, Colo.

Immense Profits making French plate mirrors; patented process; easily learned. Plans free. Wear, Excelsior Springs, Mo.

Miscellaneous

Beautiful Registered Bull Pups, $15. Bulldogs, 501 Rockwood, Dallas, Texas.

Forms to cast Lead Soldiers, Indians, Marines, Trappers, Animals, 151 kinds. Send 10c for illustrated Catalogue. H. C. Schiereke, 1034-72nd St., Brooklyn, N. Y.

Gears and Model Supplies of every description. Catalog 10 cents. Experimenters Supply House, Box 10, Station Y, New York City.

Moulds

Moulds Making Toys. See ad on page 287. Miscellaneous. H. C. Schiereke.

Musical Instruments

Violins—Deep, Mellow, Soulful—on easy credit terms. High grade, wonderful instruments of my own make. Development of many years' experience. Write for book. Gustav A. Henning, 302 University Building, Seattle, Washington.

Old Coins

California Gold, quarter size, 27c; half-dollar size, 53c Columbian nickel and catalogue, 10c. Norman Shultz, Box 746, Salt LaLke City, Utah.

Old Money Wanted

$2 to $500 Each paid for hundreds of Old or Odd Coins. Keep all old money, it may be very valuable. Send 10c for new illustrated coin value Book 4x6. Guaranteed Price. Get Posted, we pay Cash. Clarke Coin Company, 14 Street, LeRoy, N. Y.

Patent Attorneys

Patents obtained under Co-operative Payment Plan. Write for particulars. W. E. Beck, Registered Patent Lawyer, 952 Baltic Bldg., Washington, D. C.

Inventors who derive largest profits know and heed certain simple but vital facts before applying for Patents. Our book Patent Sense gives those facts; free. Lacey & Lacey, 644 F. St., Washington, D. C. Established 1869.

Patents—Write for Instructions, Carl Miller, Registered Patent Attorney (former Patent Office examiner). 211-B McGill Building, Washington, D. C.

Patents—Free advice. Confidential, prompt personal service of Registered Patent Attorney, former Patent Office Examiner. Booklet. Albert Jacobs, 728 Barrister Bldg., Washington, D. C.

Patents procured at reasonable rates with time to pay. Sales negotiated. Staff of registered attorneys and engineers. A complete service for inventors. Write for particulars. Inventors Service Bureau, Box 1648, Washington, D. C.

John Patten Duffie, registered patent attorney, Victor Building, Washington, D. C. Reasonable rates. Advice free. Booklet.

Patents—Free valuable book sent upon request—Save time—Forward sketch or model for our free confidential report. Favorable report rendered only when we conscientiously believe your invention contains merit and is of commercial value. American Industries, Inc., 224 Victor Bldg., Washington, D. C.

Patents. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Attorney, Washington, D. C.

Richard B. Babcock, Patent Lawyer, Washington Loan & Trust Bldg., Washington, D. C., Booklet.

Monroe E. Miller, Ouray Bldg., Washington, D. C. Patent Lawyer, Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule information free. Lancaster and Allwine. Registered Patent Attorneys in United States and Canada, 242 Ouray Bldg., Washington, D. C.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars. (Copyrighted). Write W. T. Greene, 809 Baltic Bldg., Washington, D. C.

Patents. Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for Free book. "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, Security Bank Building (directly across street from patent office), Washington, D. C. See page 267.

"Inventor's Advisor." Valuable Patentbook sent free. Labiner, 3 Park Row, New York.

ADAM E. FISHER, Registered Patent Attorney, in business 25 years; references; personal attention and promptness assured; Dept. E. 205 Enright, St. Louis, Mo.

Patent, Trade-Marks. Copyrights. Reliable services by an experienced practitioner devoting personal attention to each case. Inquiries invited. Reference furnished. B. P. Fishburne, Patent Lawyer, 525-D McGill Building, Washington, D. C.

Patents Procured; Trade Marks Registered—A comprehensive experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Irving L. McCathran, 202 Owen Bldg., Washington, D. C., or 41-T Park Row, New York.

Patents

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Patents for Sale

Patents listed for sale. Inventors Service Bureau, Box 1648, Washington, D. C.

Patents Wanted

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Mr. Inventor—If you have a patent or invention for sale, write Hartley, 38 Court St., Bangor, Me.

Photography

Have you a Camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 118 Camera House, Boston, 17, Mass.

Big Opportunities! Learn at home; Motion Picture Photography, portrait, Commercial or news photography; write for catalog. New York Institute of Photography, Dept. 82A, 10 W. 33d St., N. Y.

Photoplays Wanted

$ $ $ For Photoplay Plots, Stories accepted any form, revised, criticised, copyrighted, marketed. Estab. 1917. Booklet free. Universal Scenario Co., 223 Western & Santa Monica Bldg., Hollywood, Calif.

Printing Outfits and Supplies

Print your own cards, stationery, circulars, paper, etc. Complete outfits $8.85; Job Presses $11, $29; Rotary $149. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Kelsey Company, F-6 Meriden, Conn.

Radio

Be the Licensed Radio Doctor in Your Community. $7-$10 spare time evenings. Our co-operative plan procures all the work you want. Secure franchised territory now. Free booklet. Co-Operative Radio Doctors, Dept. S, 131 Essex St., Salem, Mass.

Buy Your B Power Devices direct from Factory. Send for particulars. D. L. & G. Mfg. Co., 2911 W. Lake, Dept. 10, Chicago.

Your Power Troubles Solved. Sturges "AB" eliminators, bulb "B" dry trickle. Completely automatic. $25.00 complete. Literature. Wilmax, 819 DeKalb Ave., Brooklyn, N. Y.

Salesmen Wanted

A Paying Position Open to representative of character. Take orders shoes—hosiery direct to wearer. Good income. Permanent. Write now for free book. "Getting Ahead." Tanners Shoe Mfg. Co., 6603 C St., Boston, Mass.

Intelligent semi-outdoor work in own city. No selling or canvassing, whole or part time. P. O. Box 10, Fordham, N. Y. C.

Sell us your spare time. Solicit subscriptions for two leading magazines in your city. You can make a dollar an hour easy. Write for full information. Agency Dept., Experimenter Publishing Co., 230 Fifth Ave., N. Y.

66 Miles on 1 Gallon—Sensational New Moisture Gas Saver. All autos, 1 Free to Introduce. Critchlow, G-863, Wheaton, Ill.

Punchboard Salesmen. 2 hours daily. $100 every week. New line. Lowest prices. Full commission on repeat business. Catalog Free. Puritan Novelty Co., 1409 Jackson, Chicago.

Salesmen—$1,000.00 Reward If We Can't Increase your income, full or part time. Experience unnecessary. Every business must use envelopes, letterheads, billheads, etc. Our big line 25 printed necessities unequalled in quality and price. Local printers unable to compete. Fast deliveries. 600 free cuts. Easy sales. Exceptional commissions. Pocket samples free. Kaeser & Blair, 84 Murdock Bldg., Cincinnati, Ohio.

Song Poems

Song-poem Writers. Address Monarch, 236 West 55th, Dept. 133, New York.

Song Poem Writers—Send for proposition. Ray Hibbeler, D24, 2104 N. Keystone Ave., Chicago.

Song Poem Writers, Write Sequoia Songwriters' Service, Sherman Branch, Los Angeles, Calif.

Sporting Goods

English War Office Field Glasses $7.95; used genuine Colts $14.75; Holsters $1.00; Exercisers $1.20. FREE catalog. Hudson Sporting Goods, 50 Warren St., New York.

Typewriters

Typewriters, all standard makers. $10 up. Fully guaranteed. Free trial. Write for complete Illustrated lists. Northwestern Exchange, 121 N. Francisco Ave., Chicago.

EDGAR ALLAN POE
THE FATHER OF SCIENTIFICTION

GREATEST OFFER EVER MADE

Never before has it been possible to obtain the complete works of America's greatest author and genus, Edgar Allan Poe, for the amazingly low price that we now offer them to you.

Edgar Allan Poe has come to be looked upon as the greatest literary genius that America has ever produced. He is the originator of the first "Scientifiction" stories—fiction with a plausible scientific background. Jules Verne and H. G. Wells freely acknowledge him as the originator of modern scientifiction.* In addition, there is little doubt but that the well known SHERLOCK HOLMES is the product of the inspiration that Sir Arthur Conan Doyle found in the works of Poe. Take advantage of this special introductory offer. There is just a limited number of copies in this edition.

.....Like a razor also, the pendulum was massy and heavy, it was appended to a weighty rod of brass, and the whole *hissed* as it swung through the air. I saw that the crescent was designed to cross the region of the heart. Down—steadily down it crept. The rats were wild, bold, ravenous, their red eyes glaring upon me. And then.....

From "The Pit and the Pendulum."

COMPLETE WORKS

$2.55

10 Volumes Cloth Bound
OVER 2000 PAGES

The complete works of Edgar Allan Poe are published in 10 beautiful volumes. Handsome red cloth cover. Special egg-shell paper, made to order for this set. Printed from plates made for the well-known Richmond Edition. Each volume contains an average of 200 pages. Size of type is long primer, which is easy reading and restful to the eyes. The volumes are handy in size, 4 x 6¼ inches. The greatest offer ever made. This is the chance of a lifetime. Take advantage of this astounding low price offer. Fill in the coupon now. Send no money—pay the postman $2.55 on delivery. We pay the mailing charges.

***All Scientifiction Stories in list of contents are identified with a star and printed bold face.**

CONTENTS OF THE SET

VOLUME ONE

Memoir of Wm. H. Rogers.
Eulogy by James Russell Lowell.
Notice by N. P. Willis.
***Adventures of Hans Pfall**
***The Gold Bug.**
Four Beasts in One.

VOLUME TWO

Murders in Rue Morgue.
Mystery of Marie Roget.
***The Balloon Hoax**
***MS. Found in a Bottle.**
***The Oval Portrait.**

VOLUME THREE

***The Purloined Letter.**
***One Thousand and Second Tale of Scheherazade.**
***A Descent into the Maelstrom.**
***Von Kempelen and His Discovery.**
***Mesmeric Revelation.**
***Facts in Case M. Valdemar.**
***The Black Cat.**
Fall of the House of Usher.
Silence—A Fable.

VOLUME FOUR

The Masque of the Red Death.
The Cask of Amontillado.
***The Imp of the Perverse.**
The Island of the Fay.
The Assignation.
***The Pit and the Pendulum.**
The Premature Burial.
The Domain of Arnheim.
Landor's Cottage.
William Wilson.

VOLUME FIVE

***The Tell-Tale Heart.**
***Berenice.** Ligeia.
Eleanora. Morella.
***A Tale of the Ragged Mountains.**
***The Spectacles.**
King Pest.
***Three Sundays in a Week.**
The Devil in the Belfry.
Lionizing.
X-ing a Paragrab.

VOLUME SIX

***Narrative of A. Gordon Pym.**

VOLUME SEVEN

Metzengerstein.
The System of Dr. Tarr and Prof. Fether.
The Literary Life of Thingumbob, Esq.
How to Write a Blackwood Article.
Predicament.
Mystification.
Diddling.
The Angel of the Odd.
***Mellonta Tauta.**
The Duc de L'Omelette.

VOLUME EIGHT

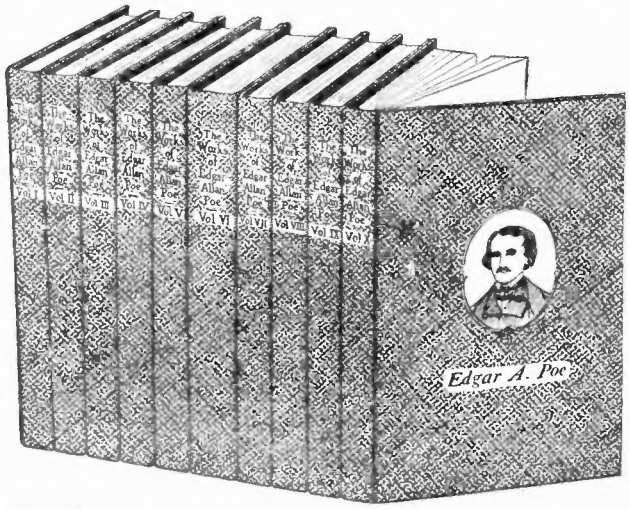
The Oblong Box.
***Loss of Breath.**
***The Man That Was Used Up.**
The Business Man.
The Landscape Garden.
***Maelzel's Chess Player.**
Poems of Words.
The Colloquy of Monas and Una.
The Conversation of Eros and Charmian.
Shadow—A Parable.
Philosophy of Furniture.
A Tale of Jerusalem.
***The Sphinx**

VOLUME NINE

Hop Frog.
The Man of the Crowd.
Never Bet the Devil Your Head.
Thou Art the Man.
Why the Little Frenchman Wears His Hand in a Sling.
Bon Bon.
***Some Words with a Mummy.**
The Poetic Principle.
The Philosophy of Composition.
Old English Poetry.

VOLUME TEN

Complete Poems.
The Raven.
The Bells.
***Sonnet to Science.**
***Al Aaraaf.**
Tamerlane.
Etc.



SEND NO MONEY!

Popular Book Corporation,
102 Park Place, New York City.

Gentlemen:—

Please send me at once, the complete works of Edgar Allan Poe, comprising of 10 volumes, as per your advertisement. I will pay the postman $2.55 upon arrival of the books. There are no extra charges of any kind, whatsoever. If the books are not as represented, I will return them to you within three days and you are then to return me my money.

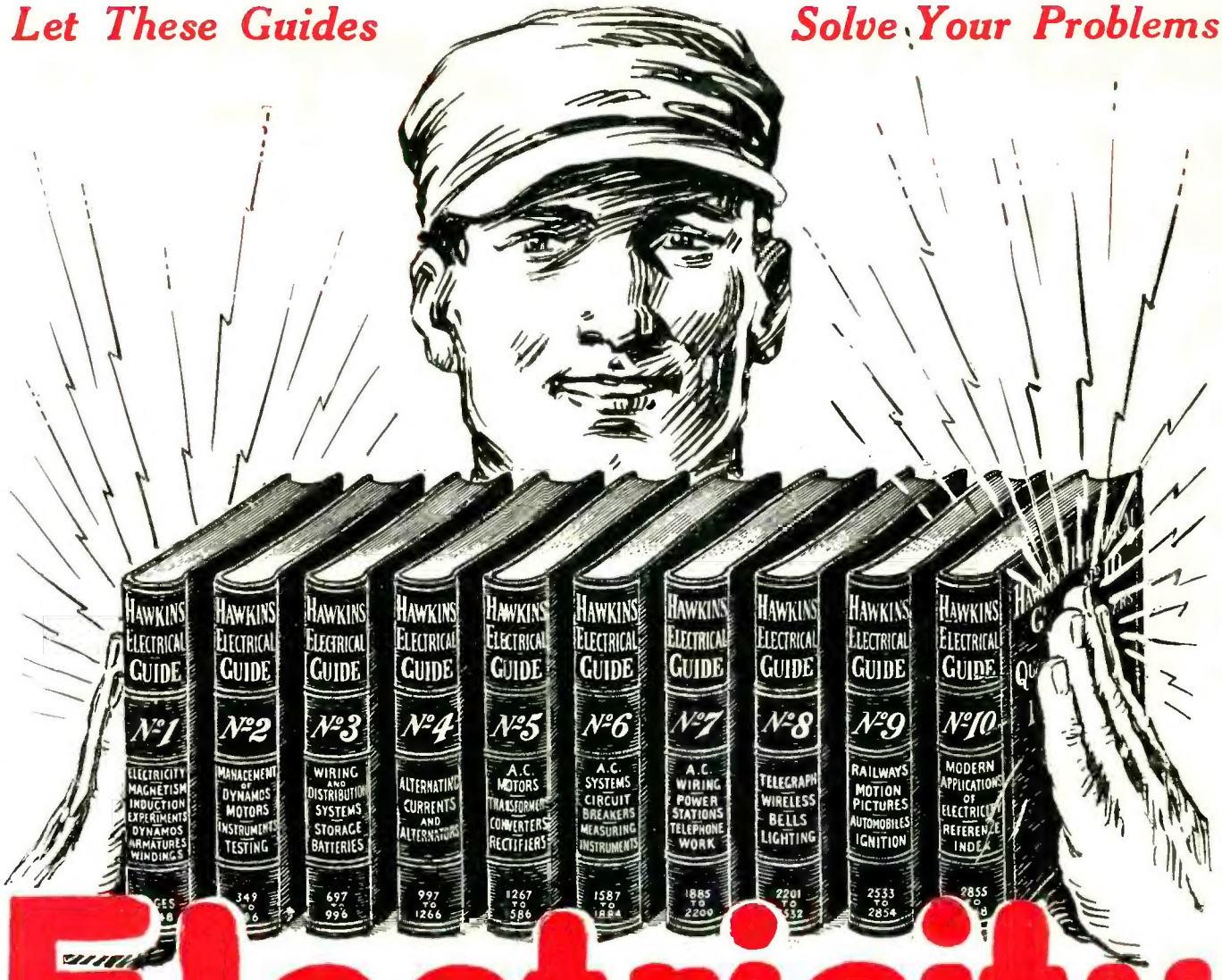
Name .....

Address .....

City ..... State.....

POPULAR BOOK CORPORATION, 102 PARK PLACE NEW YORK

Let These Guides *Solve Your Problems*



Electricity at your finger ends

HAWKINS ELECTRICAL GUIDES IN TEN VOLUMES

3500 PAGES
4700 PICTURES

$1 A VOLUME
$1 A MONTH

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set today to look over.

LEARN ALL ABOUT

Magnetism—Induction — Experiments — Dynamos — Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electrical Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams — Sign Flashers — Storage Batteries — Principles of Alternating Currents and Alternators — Alternating Current Motors — Transformers — Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switchboards—Wiring—Power Stations—Installing —Telephone—Telegraph—Wireless—Bells—Lighting—Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index of the ten numbers.

SHIPPED FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth $100 to you—you pay $1.00 a month for ten months or return it.

SEND NO MONEY—SEND ONLY THIS COUPON

THEO. AUDEL & CO.
65 West 23rd Street, New York City

Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price $1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Name.....

Occupation.....

Employed by.....

Home Address.....

Reference.....

S. I. JULY

The Gambler

He gambles that a "lucky break" will come to him in the course of time

"Things will be BETTER next year
-They're $URE to give me a rai$e"
WAIT till I get my chance!
Perhaps sometime I'll go in business for myself
$OME day I'll get a good break
$omething's BOUND to happen!

MOST men live in the **HOPE** that their "lucky break" will come **TOMORROW** or **NEXT WEEK** or **NEXT YEAR**.

They gamble that **FATE**, some day, some way, will make them rich! They risk their whole lives on what may **COME** to them in the course of **TIME**.

This is a **WORSE** form of **GAMBLING** than gambling for **MONEY** with a card sharp or a "three shell game" expert.

Gambling on what **TIME** and **FATE** have in store for you is more costly than any other form of gambling known.

You lose **MORE** than money. You lose your **SELF-RESPECT**. You lose the self-respect of those about you.

And as each year passes your **CHANCE** to amount to anything becomes slimmer and slimmer.

You get discouraged. You begin to feel that fate is **AGAINST** you. You complain secretly about your ill luck. Perhaps you hide your shortcomings behind a whole flock of easy **EXCUSES**.

But the hard, cold world doesn't care about you.

You've got to look out for **YOURSELF**.

Time alone cannot help you. If it could, **EVERY** man over 70 would be rich.

You cannot **COUNT** on luck or fate or circumstances. If you could, **EVERYBODY** would get rich at some time or other.

Your life is too precious to waste away **WAITING** for "something to turn up."

There's **ONE SURE WAY**—yes, **ONLY** one sure way—to get what you want out of life.

Nothing can help you but your own **BRAIN**. Make your brain just a little bit more effective and you will **MULTIPLY** your earning power.

There is **NO LIMIT** to what the human brain can accomplish. Scientists and psychologists tell us we use only about **TEN PER CENT** of our brain power. Ninety per cent is unused. It lies dormant. The longer it is unused, the harder it becomes for us to use it. For the mind is like a muscle. It grows in power through exercise and use. It weakens and deteriorates with idleness.

What can you **DO** about it? That is the question you are asking yourself. Here is a suggestion.

Spend 2c for a postage stamp. Send in the coupon below for a copy of "Scientific Mind Training." There is no further obligation whatever. You need not spend another penny.

Read this little book. It has opened the eyes of hundreds of thousands of other individuals who had the same problems you have. Over 650,000 people, in all parts of the world, and in all walks of life have followed the advise given in this booklet. Lords and servants, princes and laborers, captains of industry and clerks, bookkeepers and bankers, men **AND WOMEN** of all types and of all ages have read this book and have changed their whole scheme of existence as a result.

This little book will tell you the secret of self-confidence, of a strong will, of a powerful memory, of unflagging concentration. It tells you how to acquire directive powers, how to train your imagination (the greatest force in the world), how to make quick, accurate decisions, how to reason logically—in short, how to make your brain an instrument of all-around **POWER**. It tells you how to banish the negative qualities like forgetfulness, brain fag, inertia, indecision, self-consciousness, lack of ideas, mind wandering, lack of system, procrastination, timidity.

Men like Judge Ben B. Lindsey, Sir Harry Lauder, Prince Charles of Sweden, Jerome K. Jerome, the famous novelist; Frank P. Walsh, Chairman of the National War Labor Board, and hundreds of others equally famous, praise the simple method of increasing brain power and thought power described in this free book. **OVER 650,000 OTHERS PRAISE IT.**

You have only **TWO CENTS** to lose by writing for your copy. You may **GAIN** thousands of dollars, peace of mind, happiness, independence!

Thousands who read this announcement will **DO NOTHING** about it. The effort and the will needed to send for this book—which is **FREE**—may be lacking. How can these people **EVER** gain what they hope for, crave for? They are the skeptics, the doubters, the "show me" wiseacres.

Other thousands will say, "I can lose only **TWO CENTS**. I may **GAIN** a great deal by reading 'Scientific Mind Training.' I will send for it **NOW**. It promises too much for me to **RISK MISSING**."

The thousands who are open minded—who are willing to learn something to their advantage—will **ACT** on their impulse to send the coupon. They will be better, stronger minded for having **TAKEN SOME ACTION** about their lives, even if they do nothing more than to **READ** a booklet about the inner workings of the mind. For your own sake—and for the sake of your loved ones, don't continue to **GAMBLE** that your future will be bright whether or not you **DO** anything about it! Mail the coupon today —**NOW**.

THE PELMAN INSTITUTE OF AMERICA

Suite 327, 71 West 45th Street, New York City

Offices in London, Paris, Stockholm, Delhi, Durban and Melbourne

The Pelman Institute of America
Suite 327, 71 West 45th Street,
New York City

Please send me without obligation your free booklet, "Scientific Mind Training." This does not place me under any obligation and no salesman is to call on me.

Name_____

Address_____

City_____ State_____